Office of Engineering
Division of Facilities & Transit

AEC APPLICATIONS

Version 1
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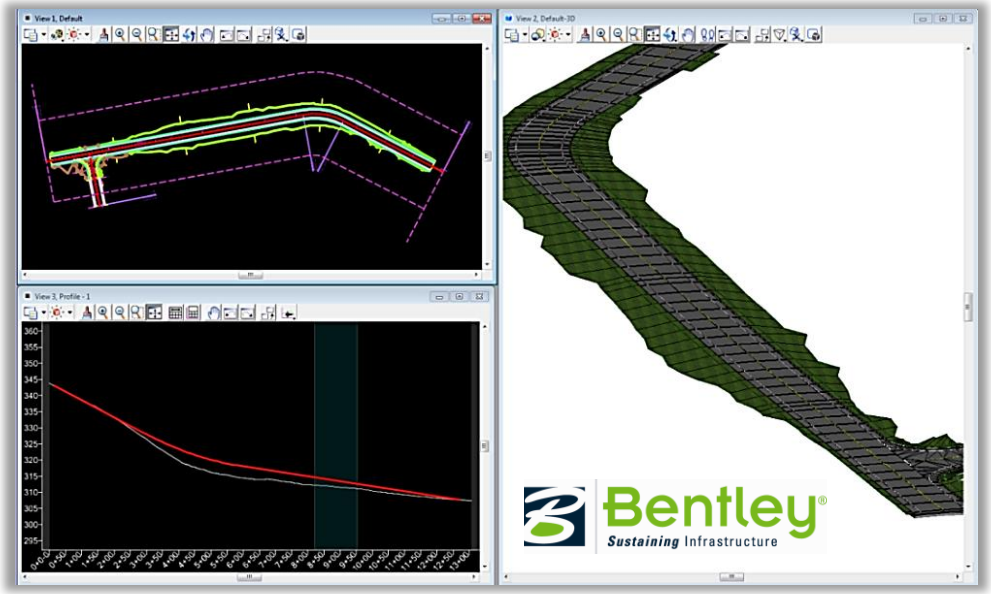


CTDOT OPENROADS MANUAL FOR DESIGNERS

INTRODUCTION

The purpose of this manual is to introduce CTDOT users to the latest OpenRoads technology. AEC Applications provides an OpenRoads Managed Workspace through the use of ProjectWise. This workspace provides the standardization users will need to prepare their design. All OpenRoads projects will be done in the ProjectWise (PW) document management system environment and will use Managed Workspaces to implement the latest CTDOT CADD Standards.

Bentley ProjectWise (PW) is a collaborative environment which allows all parties involved in the project to use live data and to make real time decisions. It also allows CAD support to immediately update or edit any necessary Workspace resource. All CTDOT employees should have a ProjectWise account. If you do not, or if you experience difficulties logging in, please contact Julie Annino via email: Julie.Annino@ct.gov

When starting a new OpenRoads Project do not copy over or open any DGN files that were used on the X Drive, these files do not use the correct settings. You may reference them in as needed but using them and running OpenRoads will cause problems.

Selecting the Bentley Institute Icon throughout this manual will link users to training videos on the Bentley LEARNServer. These videos are part of the OpenRoads Technology – Getting Started Learn Path.

Before getting started AEC recommends viewing these first 2 videos to get acclimated with the application and the terms used throughout this guide.

Understanding
OpenRoads technology

Become Familiar with
the OpenRoads
Interface and Tools

Written by: Elaine Richard, John Rinaldi,
Samantha Scharpf & Gabriele Hallock

Chapter 1 Step By Step Start Up

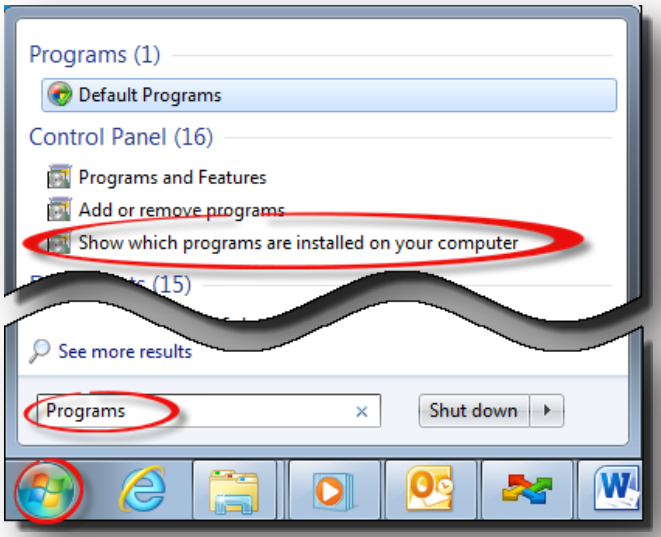
Steps 1 thru 5 will be only have to be done at the initial start up and then if again if a user gets upgraded software, they receive a new computer, or their computer has to be reimaged.

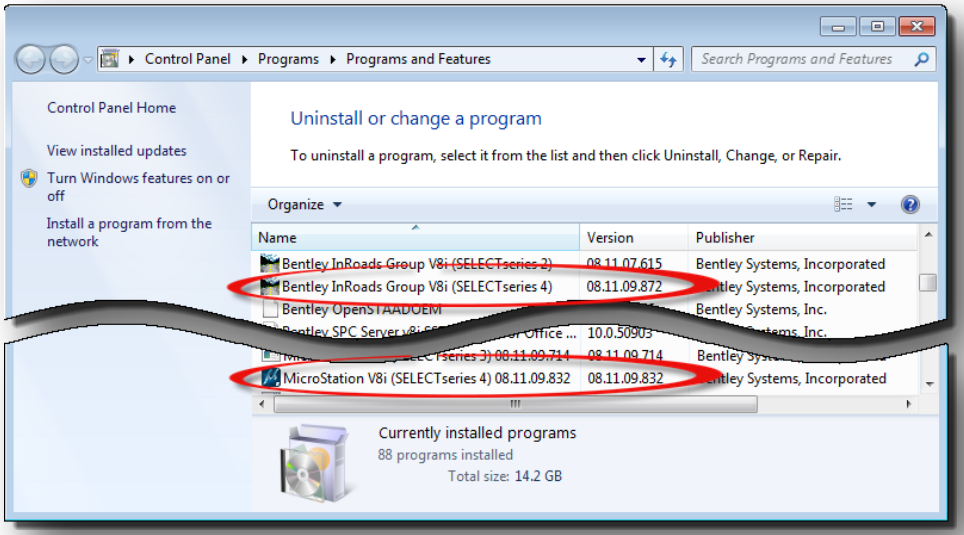
Step 6 thru 11 will need to be completed for every new project a user works on.

Step 1 Verify Software Installations

Verify that the required software versions have been installed on your computer by navigating to the *Windows Start Menu* and typing *Programs* into the search field. Select *Show which programs are installed on your computer* from the search results. This will open the Control Panel's Programs and Features which lists the names and versions of the installed programs.

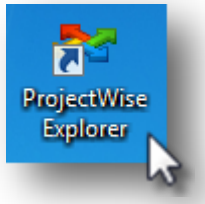
The required versions are as follows:
ProjectWise Explorer V8i (SELECTseries 4) - Version 08.11.11.566
MicroStation V8i (SELECTseries 4) - Version 08.11.09.832
Bentley InRoads Suite V8i (SELECTseries 4) - Version 08.11.09.872





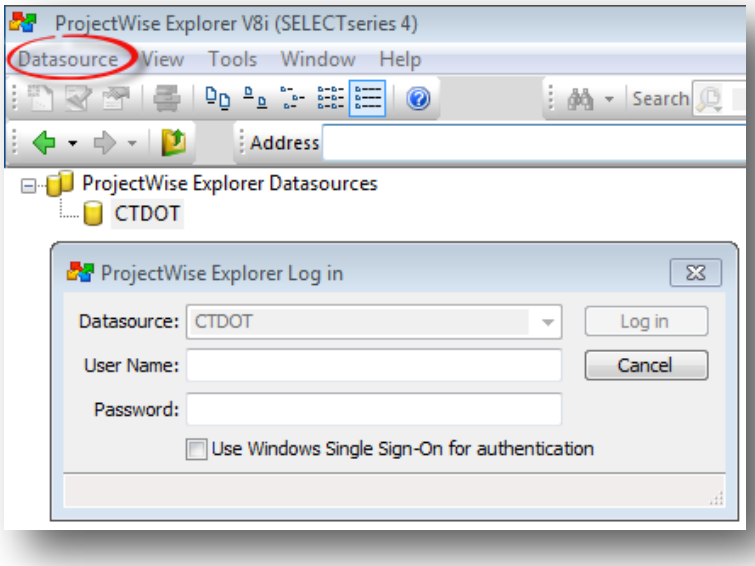
Step 2 Create a ProjectWise Desktop Shortcut

1. Select *All Programs > Bentley > ProjectWise V8i*.
2. Right click on ProjectWise Explorer and select *Send to> Desktop*.



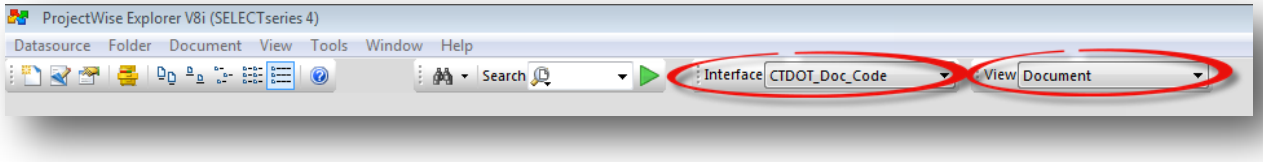
Step 3 Log in to ProjectWise

1. Double click on the newly created **ProjectWise Explorer** Icon as shown above.
2. From the ProjectWise Explorer main menu, select *Datasource > Log in…*
3. Enter your *User Name* and *Password* then select the **Log in** button.
4. Browse to locate your Project under *Documents\01.0 - Projects – Active*
5. Become familiar with the new project folder structure, it is quite different than how the X drive was structured. Two important folders will be the Highway and Survey folders.
   330_Design_Data\Highways
   500_Pre_Design\03_Central_Survey

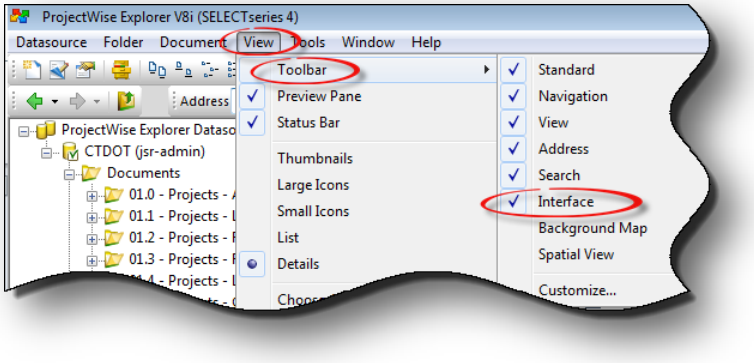


Step 3 Set ProjectWise Interface and View

ProjectWise Explorer has Interfaces and Views to display certain attributes. Ensure that for *Interface* CTDOT_Doc_Code is active and that for *View* Document is active.



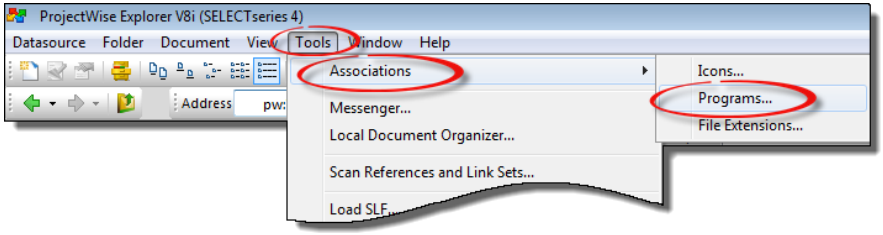
If the Interface and View are not displayed, navigate through the main menu zelect *View > Toolbar* and toggle them on.



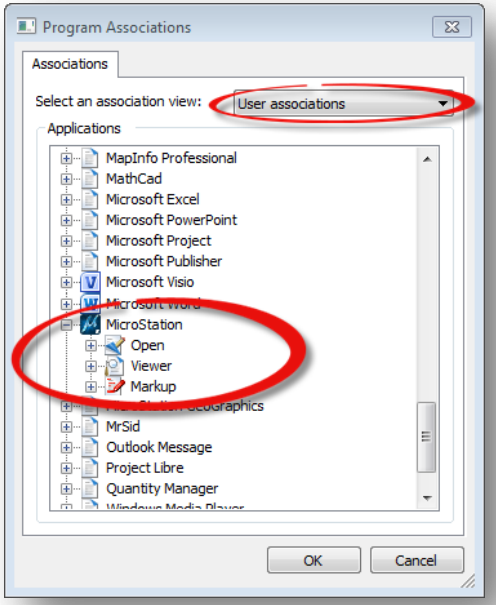
Step 4 Configure PW Open With

User Program Associations must be removed in order for MicroStation platforms and user workspaces to function properly. [Note: There is presently a service ticket filed for this]

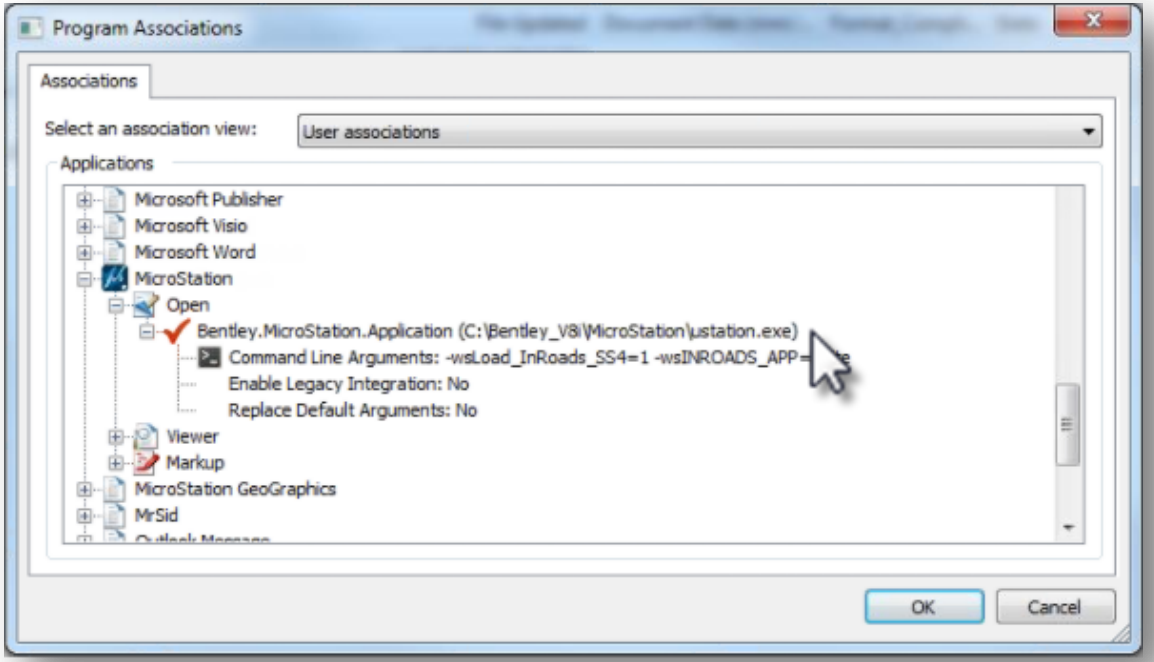
1. From the ProjectWise Explorer main menu, select *Tools > Associations > Programs*



2. From the Program Associations dialog box, use the dropdown menu to change "All Associations (global and user)" to "User associations". Scroll down to MicroStation. In this case, MicroStation has its own unique icon displayed. (This is not the case for other programs such as MrSid and Outlook Message.) This indicates that there are User associations activated which must be removed. **Expand** the MicroStation tree to display Open, Viewer, & Markup. If the MicroStation icon is just a generic icon that looks like a notepad, skip the remaining part of this step.

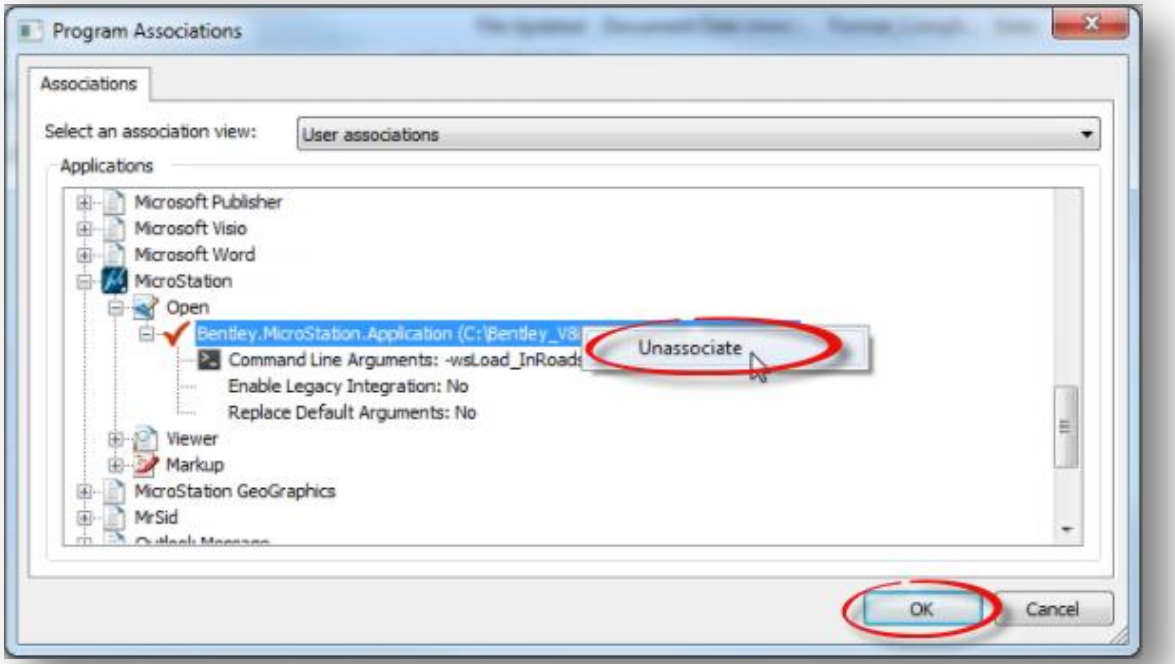


3. Expand *MicroStation > Open* and right click on the line containing *\ustation.exe*



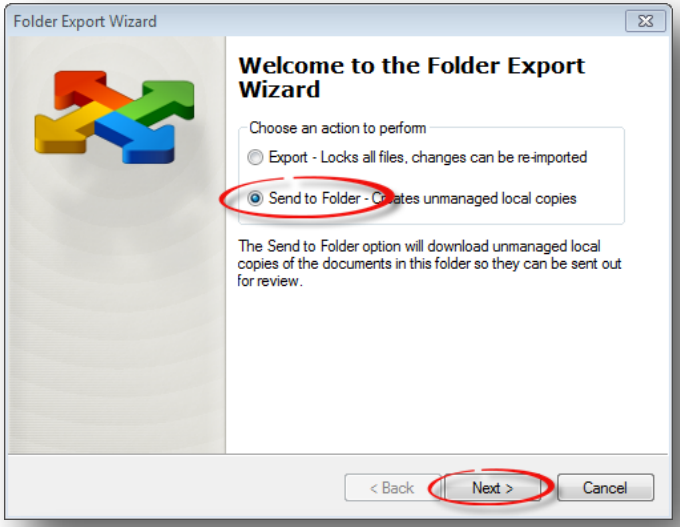
4. Choose **Unassociate** and **OK.**

5. Repeat for each **\ustation.exe** instance under **Open**. Disregard **Viewer** and **Markup**.

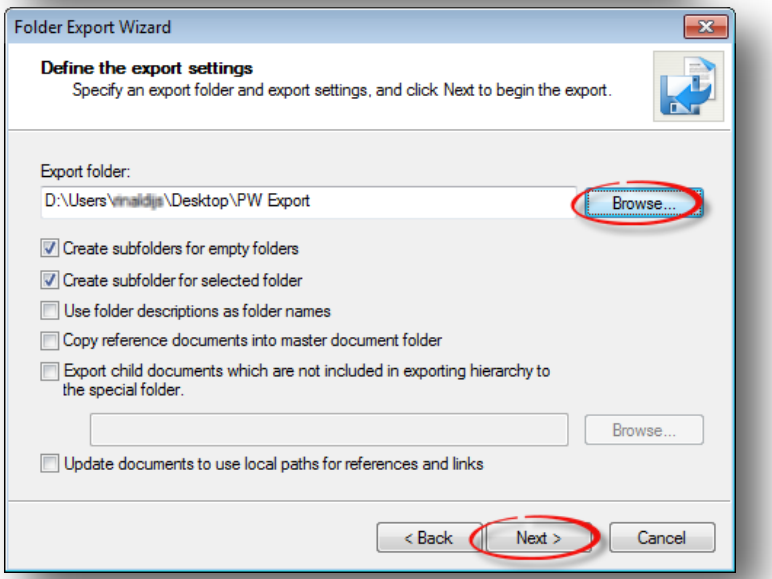


Step 5 Set up Your User Preferences

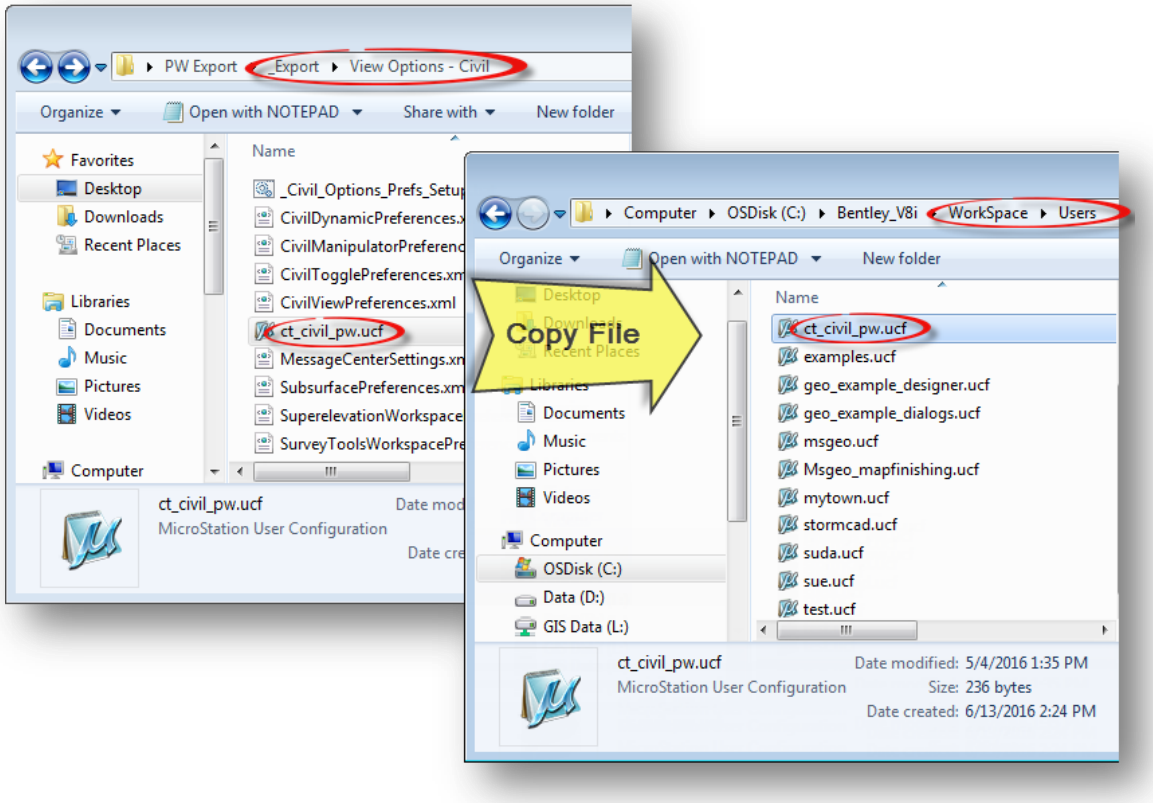
1. On your desktop create a folder named *PW Export*.
2. In ProjectWise browse to *05.0 – Workspace Resources\3_Workspace_V8i_Export\.* Right click on the _Export folder and select **Export…**
3. Choose **Send to Folder** and select **Next:**.



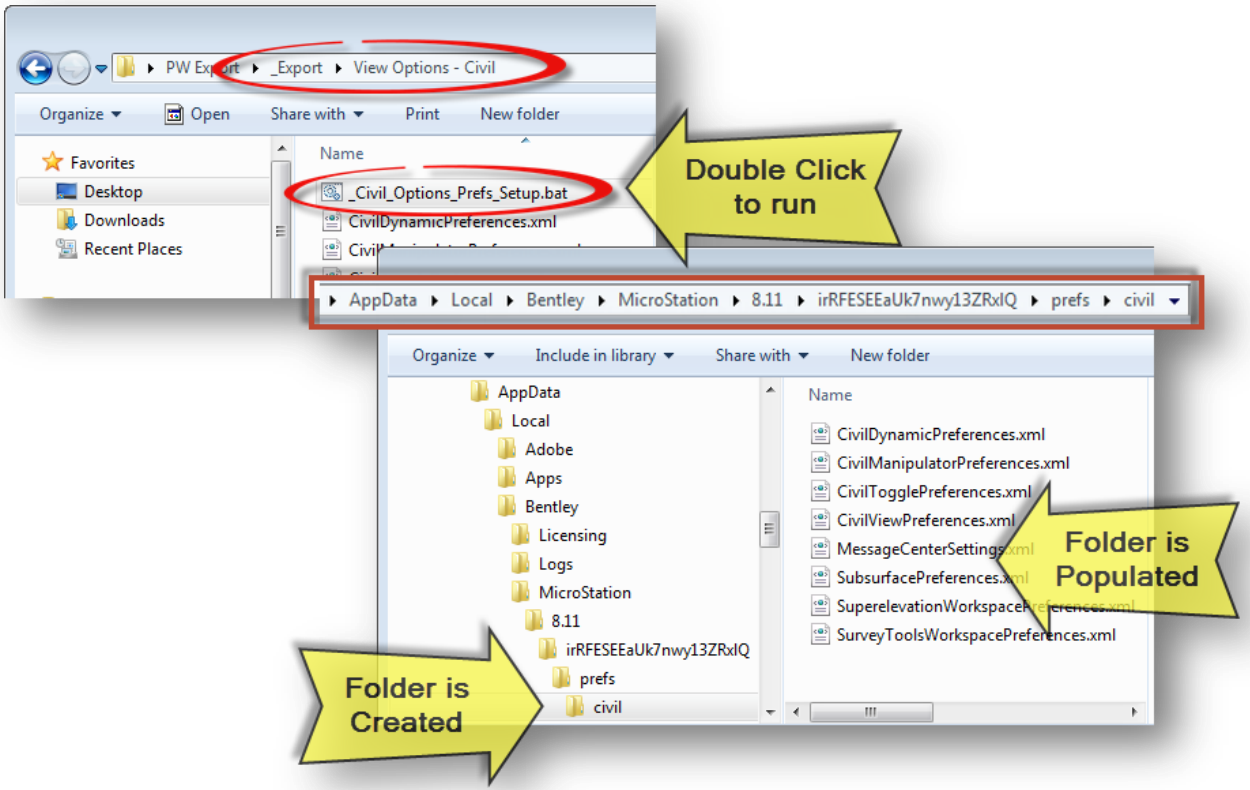
4. Browse to an export folder created in step 1 and accept to overwrite any outdated files if prompted, and **Finish**.



5. On your desk top open the folder *_Export folder\View Options – Civil* and copy *CT_Civil_pw.ucf* and *CT_MSTA_PW* to *C:\Bentley_V8i\Worksapce\Users*.

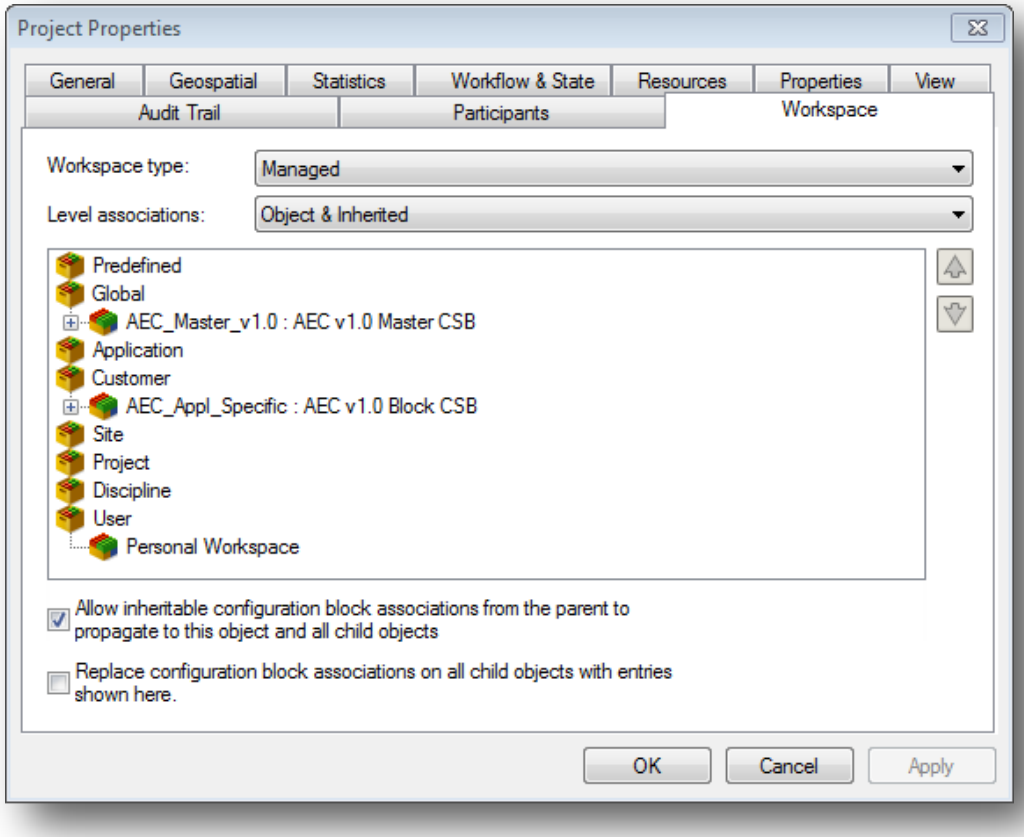


6. Again go to the *_Export folder* on your desktop, double click on *_Civil_Options_Prefs_Setup.bat* to automatically populate the civil folder with default preferences for Civil Options.



Step 6 Verify Correct Project Workspace

1. Locate the Workspace location. You will no longer be connected to the old workspace on the W drive, instead you will find the workspace at this location in ProjectWise, *Documents\05.0 - Workspace Resources\3_Workspace_V8i*
2. Check to make sure your project is configured to the correct workspace. In ProjectWise explorer right click on the project folder and choose **Properties.** All projects using OpenRoads SS4 should use the following Blocks shown in the image below. ProjectWise Configuration Settings Blocks (CSBs) are attached to projects so that CAD workspaces are read when a MicroStation design file is opened.
3. If you do not see the correct blocks please contact AEC applications and they will reset them. Users do not have access to do this.
4. Click **OK** to close the box.



Step 7 Copy Resource Files from the Workspace to your project

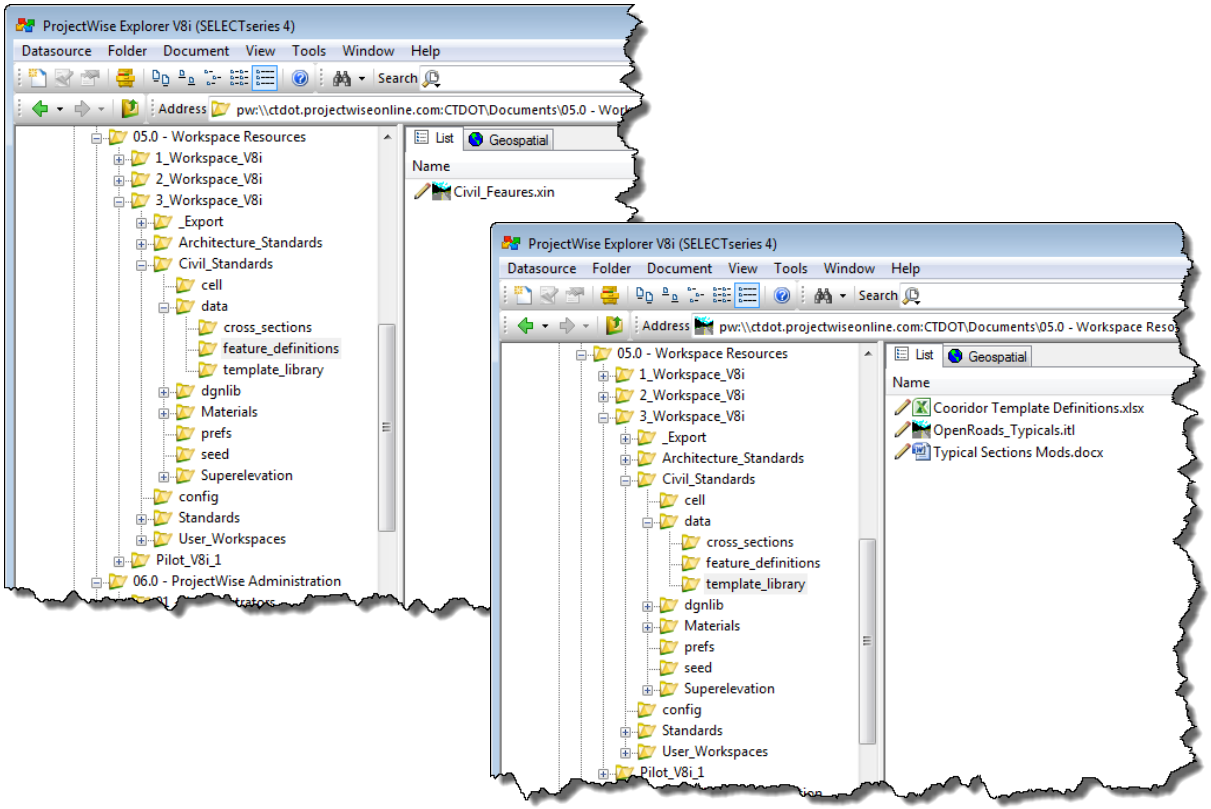
The ITL and XIN will need to be copied over from the workspace to your project discipline folder

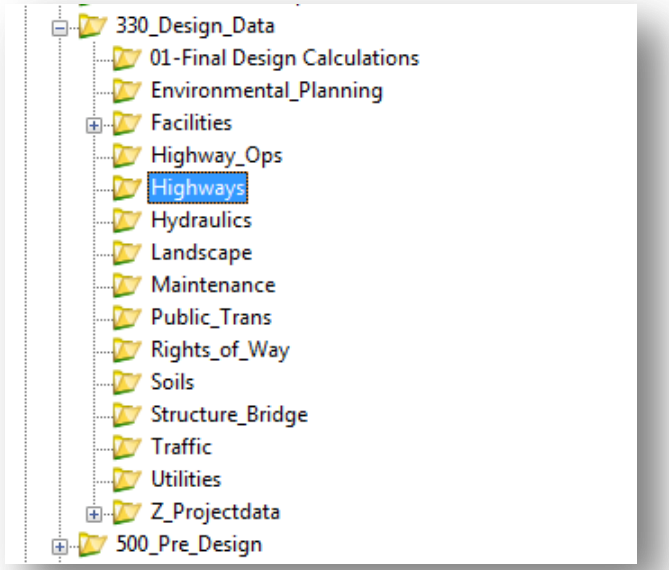
1. Browse to
05.0 - Workspace Resources\3_Workspace_V8i\Civil_Standards\data\feature_definitions\Civil_Feaures.xin

Right Click and Select **Copy.** Browse to your projects discipline folder right click and select **Paste.** When the Document Wizard appears select **No Wizard** and click the **OK** button.

2. Browse to
05.0 - Workspace Resources\3_Workspace_V8i\Civil_Standards\data\template_library\Typical Sections Mods.docx

Right Click and Select **Copy.** Browse to your projects discipline folder right click and select **Paste.** When the Document Wizard appears select **No Wizard** and click the **OK** button.





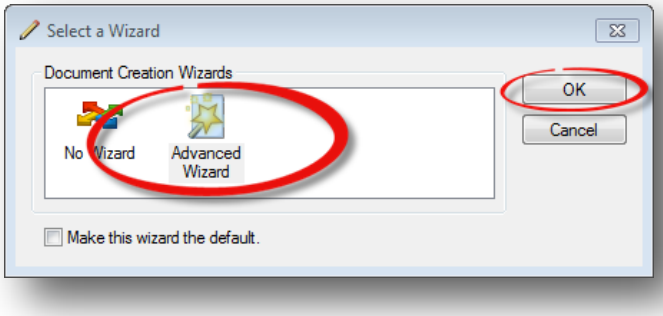
Step 8 Create a Document (MicroStation DGN File)

-Seed File Usage-

- Use a 3d DGN seed file to house your Existing Terrain.
- Use a 2D DGN seed file to start your Design Modeling (OpenRoads will automatically create a 3D model as your design progresses).
- DO NOT Drag and drop DGNs and Point Cloud files in from the Network location. These files have different working units and will not scale properly if opened in the ProjectWise environment.
- Always start with new clean seed files.

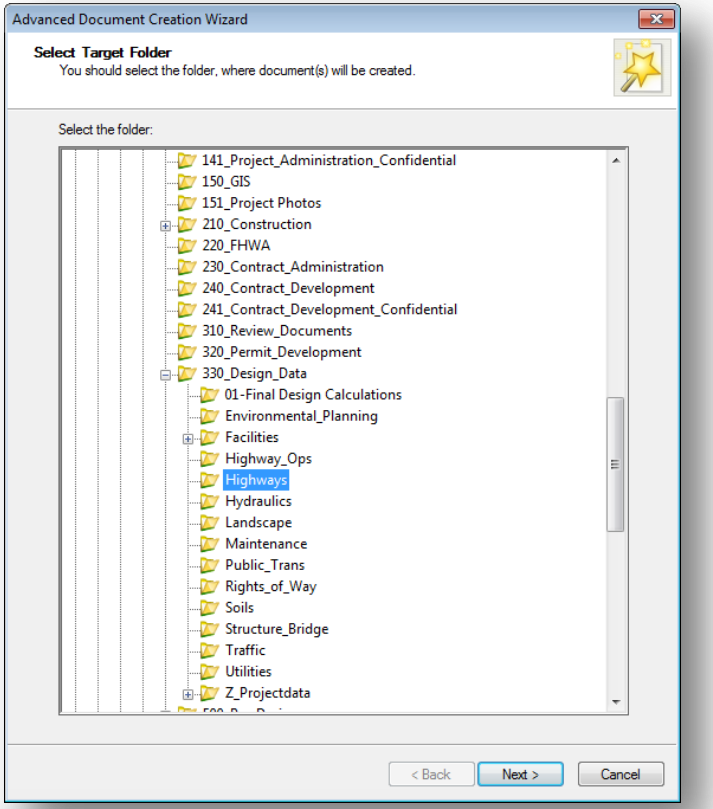
OpenRoads seed files
\Documents\05.0 – Workspace Resources\3_Workspace_V8i\Civil_Standards\seed\Seed2D-OpenRoads.dgn
\Documents\05.0 - Workspace Resources\3_Workspace_V8i\Civil_Standards\seed\Seed3D-OpenRoads.dgn

1. Select the project subfolder that you wish to work in.
   Example: *01.0 - Projects - Active\1234-1234\300_Design_Data\Highway*
2. From the main menu, select *Document>New > Document….*
3. In the *Select a Wizard Dialog Box*, select **Advanced Wizard** then **OK**.

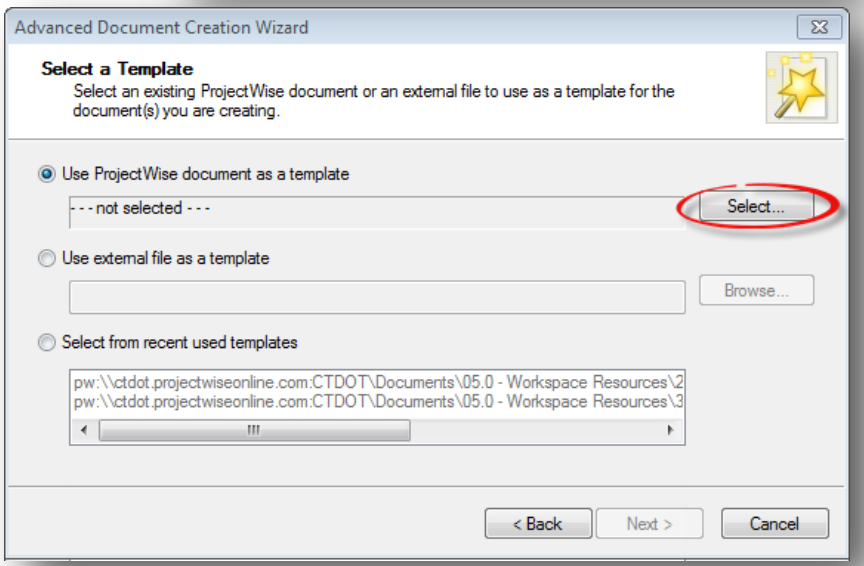


4. On the *Advanced Document Creation Wizard Welcome* dialog box Select **Next>.**

5. When prompted to Select Target Folder, verify that you are pointed to the correct folder and select **Next>**.



6. From the Select a Template options, toggle on **Use ProjectWise as a template** and click the **Select…** button. If this is not your first time creating a MicroStation file in ProjectWise, you may elect to toggle on **Select from recent used templates** and use a previously selected seed file stored in your file history and skip to the next step.



7. A Select Template Document dialog box will appear. Browse to the seed files location: *…05.0 - Workspace Resources\3_Workspace_V8i \Civil_Standards\seed\Seed2D-OpenRoads.dgn.* Select the **Open** button. The template is now populated for Advanced Document Creation. Select **Next**.

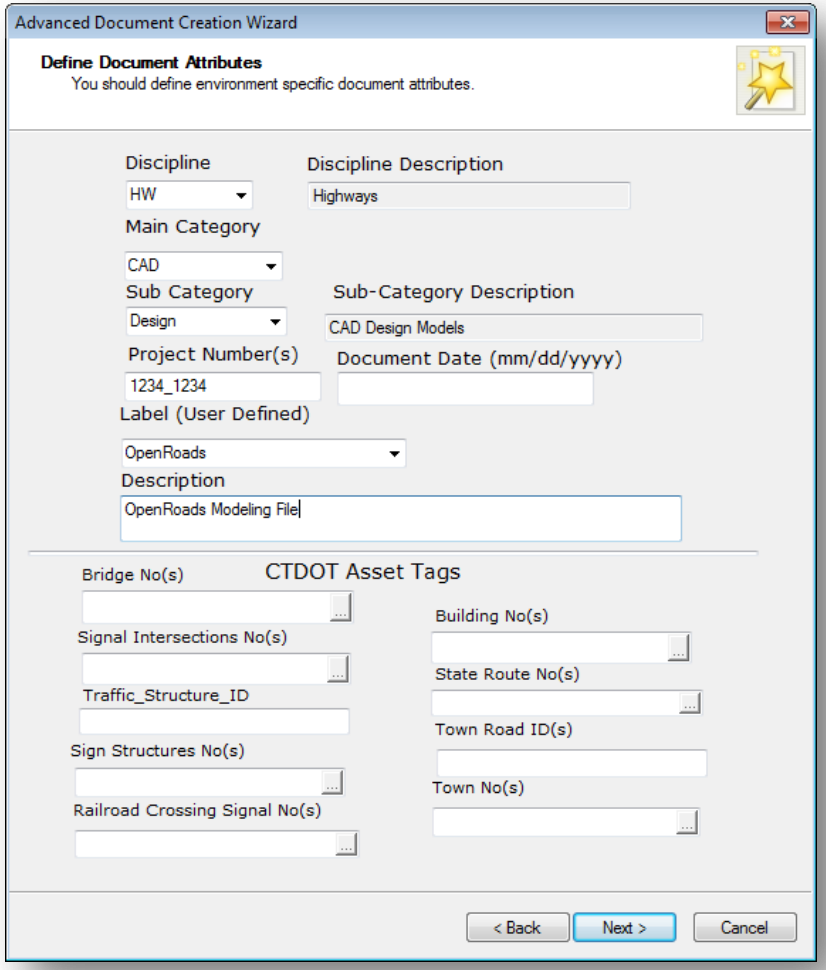
8. Select the fields to Define Document Attributes as shown. Tab to accept each field. The document file name will be built from these fields. Be sure to enter a *Label* and *Description*. These fields will be displayed and used for searching rather than the file name. Select **Next**.

9. On the Document Properties Dialog Box select **Next>**.

10. On the Create a Document Dialog box select **Next >**.

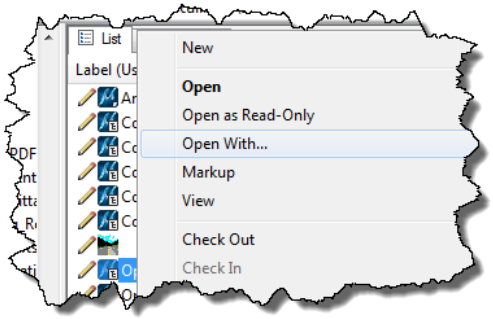
11. Click **Finish** to **Close**. The new file will now appear in ProjectWise.

12. To Update the ProjectWise Explorer Document View *data point in the view* and then select **F5** on the keyboard. This will refresh Label and Description.

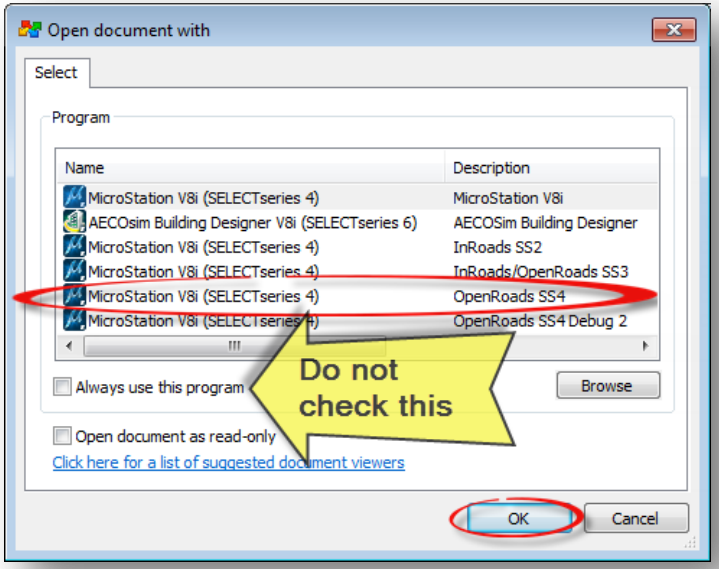


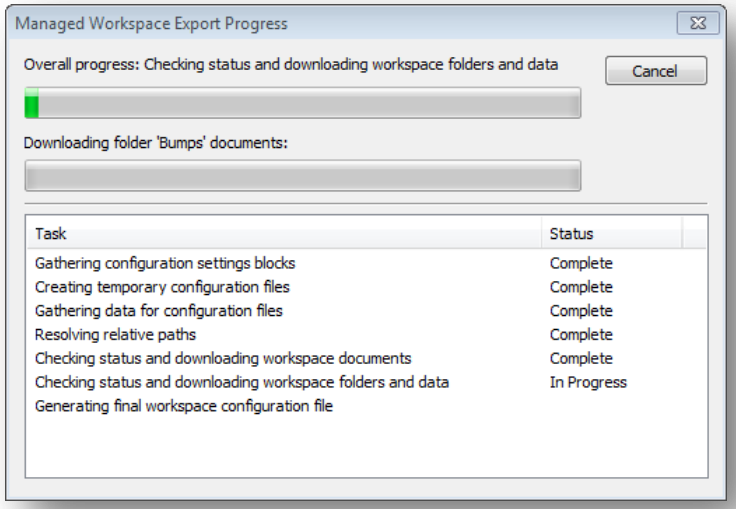
Step 9 Open a MicroStation DGN file

1. In ProjectWise Explorer browse to your discipline folder and locate the DGN file you wish to open, right click on the DGN file and select **Open With.** By default MicroStation DGN files will open with MicroStation only (i.e. no InRoads nor OpenRoads) if double clicked on, so selecting open with is imperative if you want to run OpenRoads.



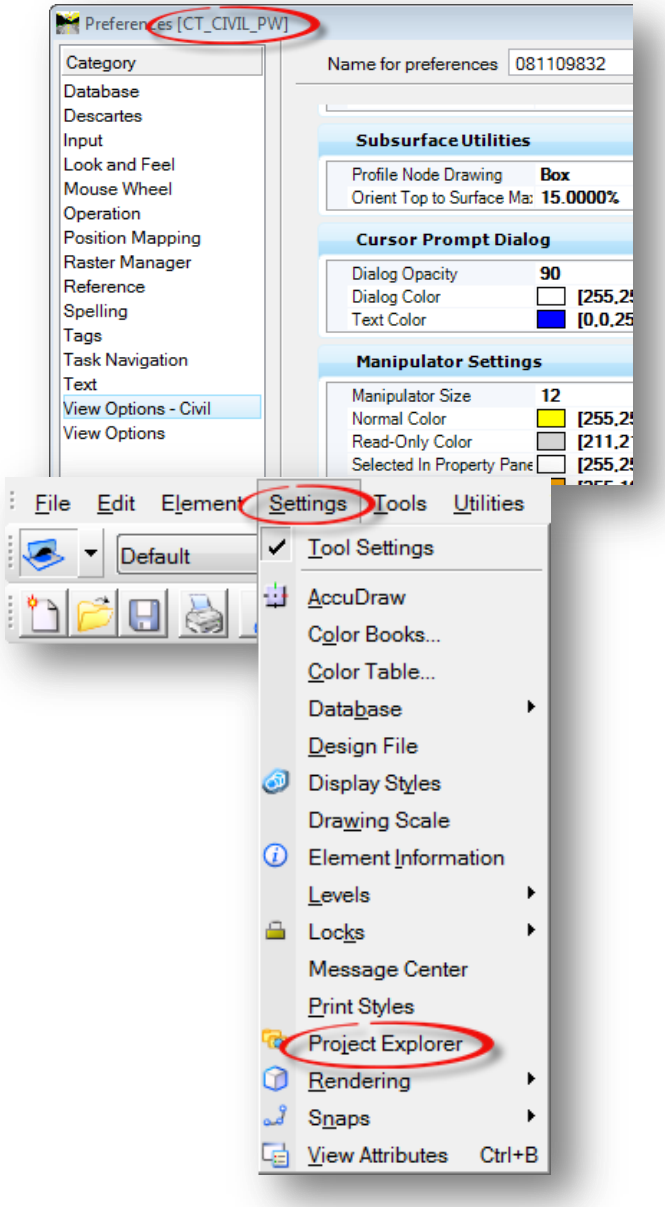
2. In the Open document with dialog box locate the Description column and select *OpenRoads SS4*. This will use OpenRoads SS4 if it is installed and also complete CTDOT configurations. The Managed Workspace will now begin to cach on your computers hard Drive.



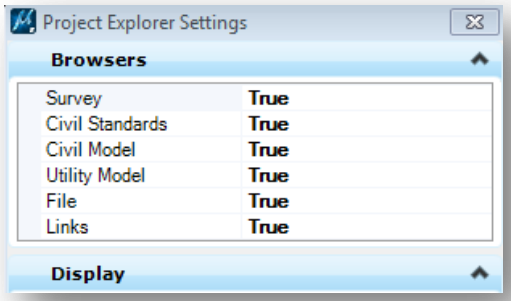


Step 10 Ensure your User Preferences are working properly

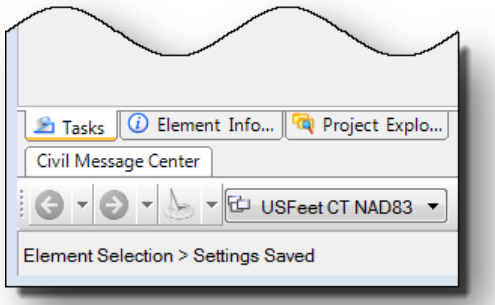
1. Now that your MicroStation File is opened you should check to make sure your User Preferences are properly set. On the MicroStation pull down menu select *Workspace>Preferences*. It should be named CT_CIVIL_PW



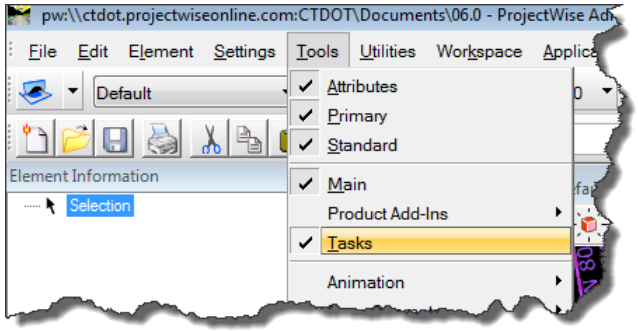
2. Ensure that all MicroStation Project Explorer settings for Browsers are set to True by selecting *Settings > Project Explorer* from the MicroStation menu.

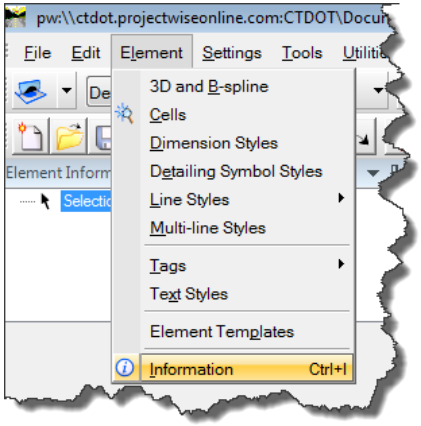


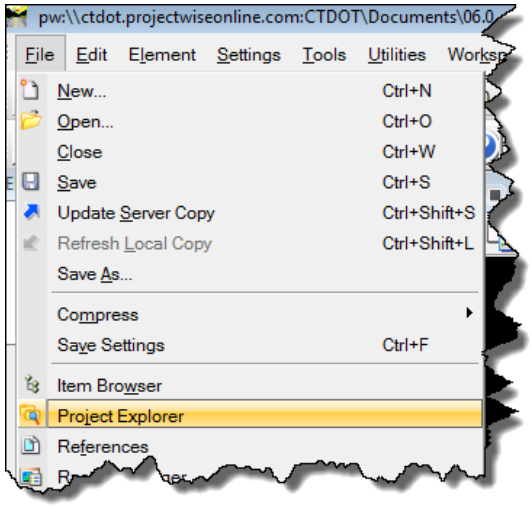
3. At the bottom of the Right side of you screen check for docking of the Tasks, Project Explorer and Element Information Tabs. You can move and doc them as desired.



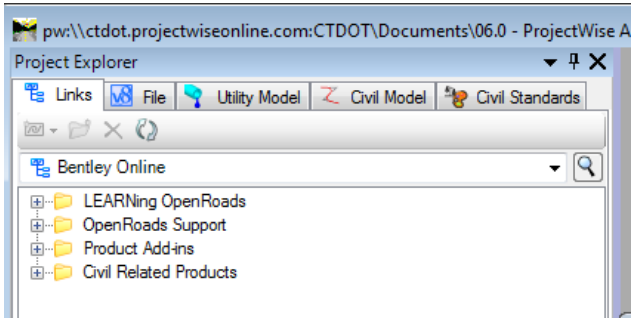
4. If the these menu are not visible you can munually turn them on using the MicroStaion pull down menu.
   For the Tasks select *Tools > Tasks*.
   For Element Information select *Element > Information*.
   For the Project Explorer select *File > Project Explorer*.





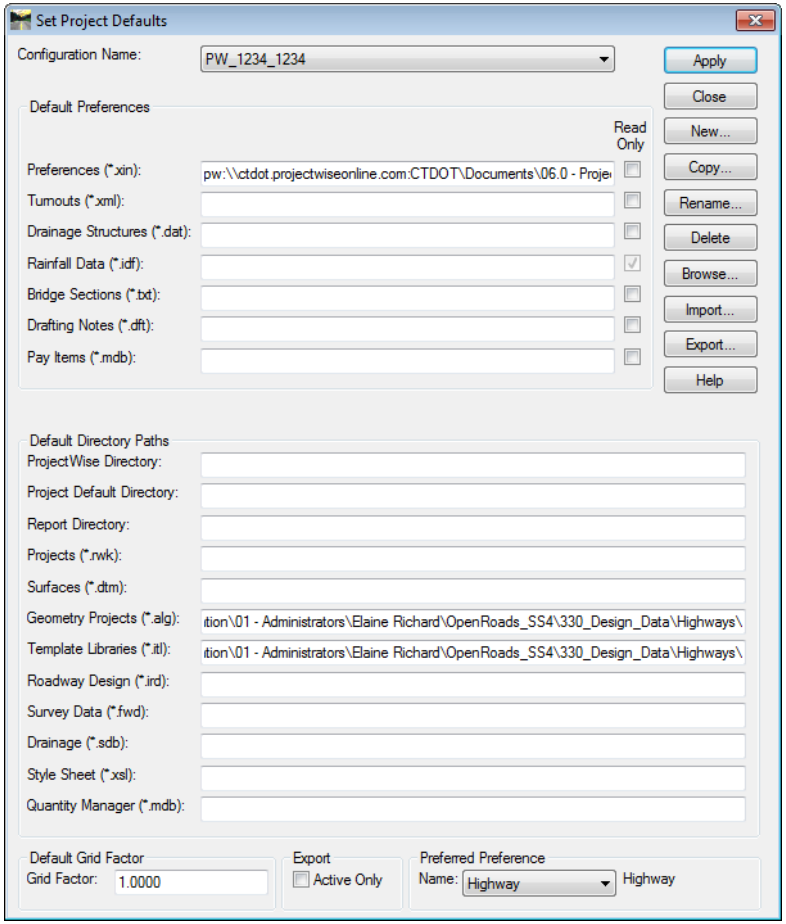


5. Locate the Bentley Online Help Videos, On the Project Explorer there is a Tab named Links. This will directly link you to Bentley's help and Training Videos.



Step 11 Set up Project Defaults

1. On the InRoads Main menu select *File > Project Defaults*. Select the **New** button and type *PW followed by the project number*. Add the XIN files and ITL path that was copied to your discipline folder as shown.
2. Copy the path from the ITL field to the Alg field.



Chapter 2 Existing Terrain

Creating and Viewing Terrain (Part 1)

Creating and Viewing Terrain (Part 2)

Section 2.1 Obtain an Existing Terrain

The concept of 2D and 3D files is very important when using OpenRoads. The existing terrain will be created using a seed file with a 3D model while the proposed design will be created using seed file with a 2D model. Keep in mind when using OpenRoads to design the MicroStation file with the 2D model will automatically create a 3D model , so you will be working with one file that had two models. Most of the work a designer does will be done in 2D. The 3D views are mostly used for checking the model and visualization. Below are three methods for creating an existing Terrain.

- Create from Fieldbook
- Create from File (DTM, LAS …)
- Create from Point Cloud

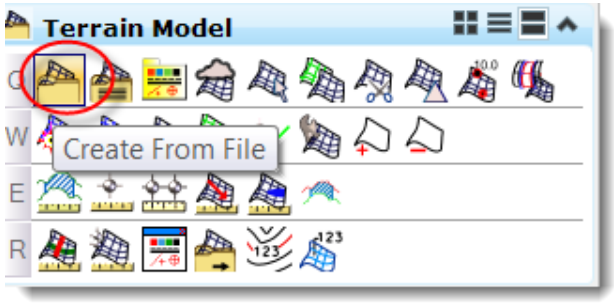
2.1.1 Create from Fieldbook

This will be done with new survey data where a DTM does not exist yet. The Survey Unit will use OpenRoads to process the fieldbook instead of InRoads SS2. Please see OpenRoads Survey Workflow for further information on this process.

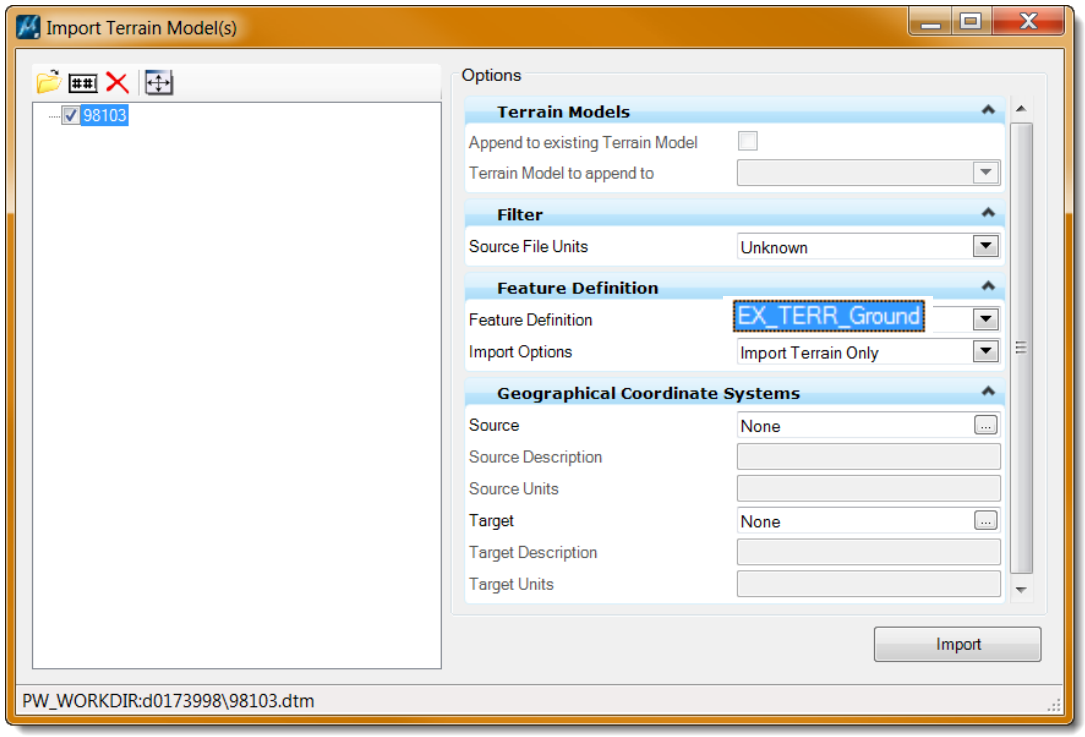
2.1.2 Create From DTM File

Request an existing terrain DGN file from Survey. In OpenRoads Survey will use the Create from File tool to convert the existing DTM to a Terrain. Below is the step they will use.

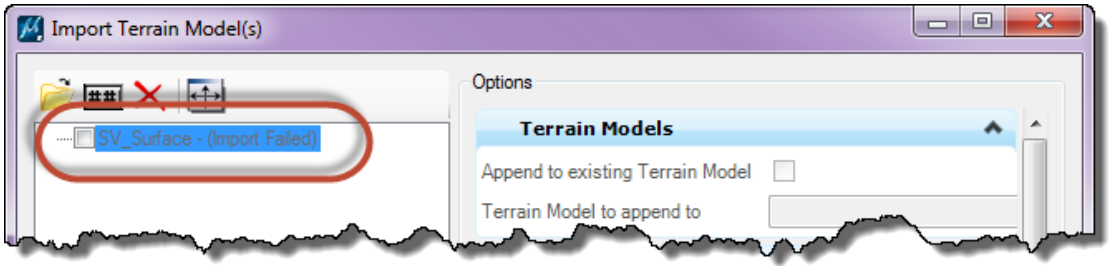
1. Complete Step 6 in Chapter 1 to create a new file. Use the file *Documents>05.0 – Workspace Resources>\3_Workspace_V8i\civil_standards\seed\ Seed3D-OpenRoads.dgn*
2. Open the file (Step 9, Chapter 1) and in the task menu select Civil Tools\Terrain Model\ Create from File tool

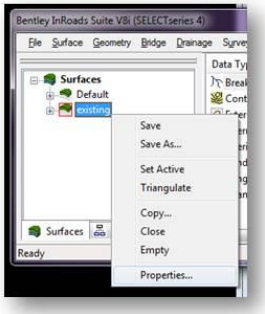


3. The Select Files to Import dialog will appear. Browse to the location of the *DTM* file to import, highlight it and click OK.
4. Another dialog box should appear. Fill out the fields as shown.
   Feature definition: *Meshes/EX_TERR_Ground*
   Import Options: *Import Terrain Only*
   Click Import

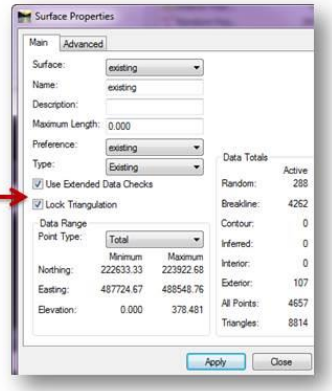


5. If an Import Failed error appears the following procedure must be done to the DTM.

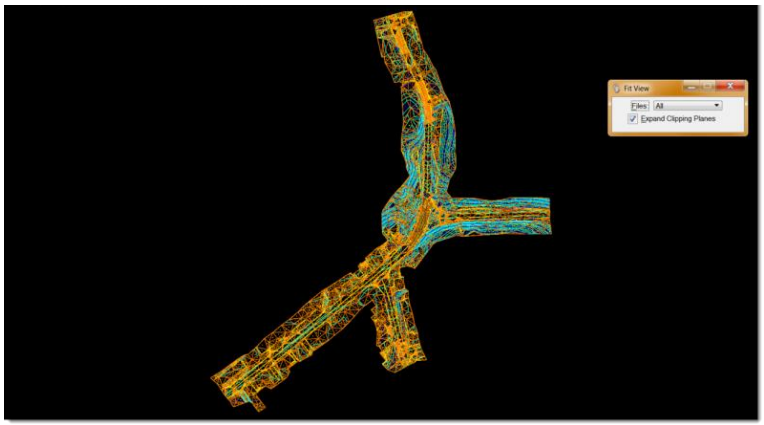




1. In InRoads open the DTM. In the InRoads Dialog Box, right click on the DTM file and select **Properties**.
2. Toggle **ON** **Use Extended Data Checks** and **Lock Triangulation**, click **Apply** and **Close.**
3. Right click on the DTM file and select **Save.**
4. Right click on the DTM file and select **Properties** again
5. Toggle **OFF** **Use Extended Data Checks** and **Lock Triangulation,** click **Apply** and **Close.**
6. Right click on the DTM file and select **Save.**



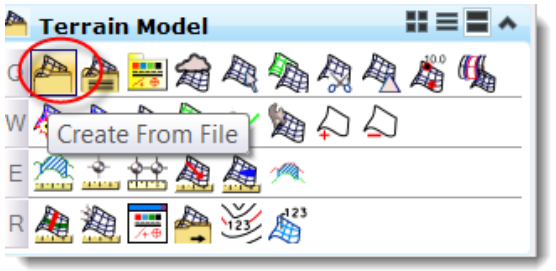
6. Go back and do *#3 & 4*. Select Fit View tool and the terrain should appear in the file.

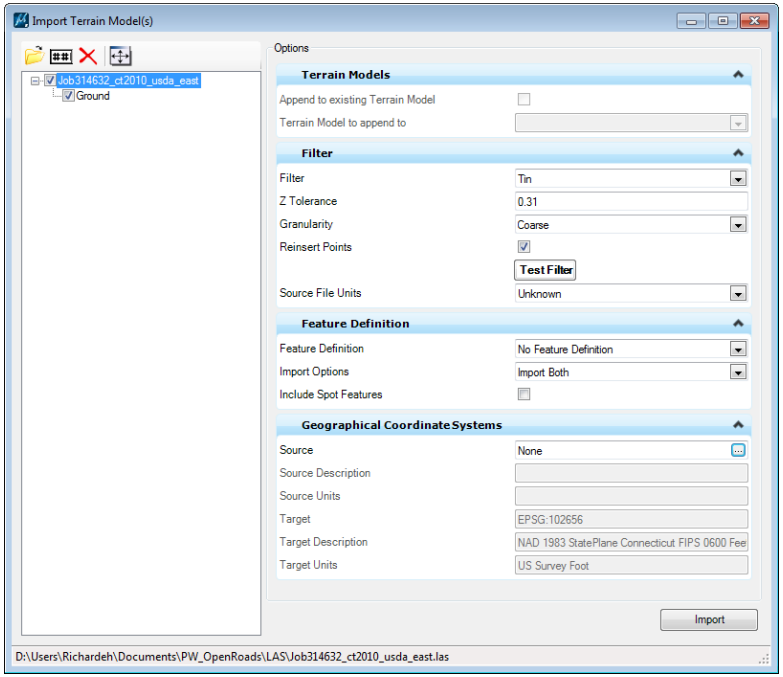


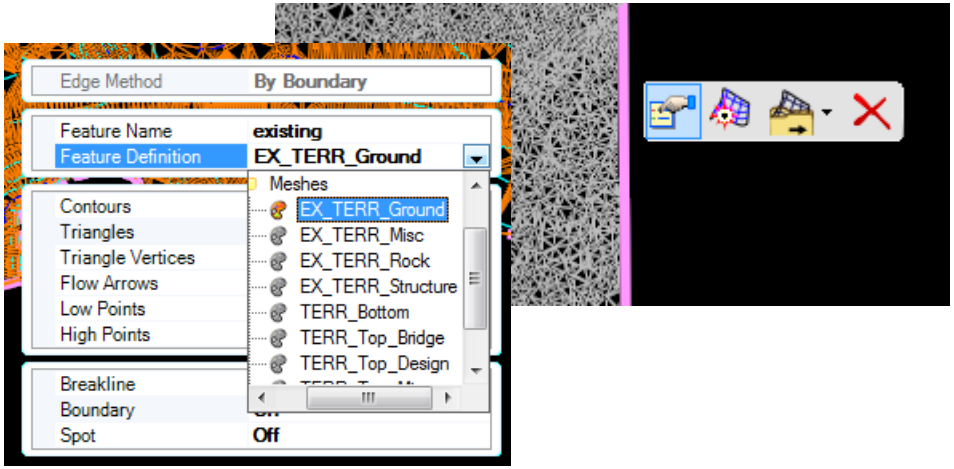
2.1.3 Create From LAS File

This method will be used when importing LAS files. While OpenRoads can handle a larger amount of surface data then a traditional InRoads DTM it still has a breaking point. For example you will lock up if you try to import a LAS file that contains the entire State of Connecticut. The point cloud tools in the next section 2.1.4 can be used to filter out unneeded areas of the LAS file data before importing to a terrain. Size Examples: A 1000 KB file imported quickly while 100,000 KB (1.5 square miles) took some processing time. The view was slow to rotate and display.

1. Complete Step 6 in Chapter 1 to create a new file. Use the file *Documents>05.0 – Workspace Resources>\3_Workspace_V8i\civil_standards\seed\ Seed3D-OpenRoads.dgn*
2. Open the file (Step 9, Chapter 1) and in the task menu select **Civil Tools\Terrain Model\ Create from File tool**
3. The Select Files to Import dialog will appear. Browse to the location of the *LAS* file to import, highlight it and click **OK**.
4. Another dialog box should appear. Fill out the fields as shown. Do not select a Feature Definition yet, this will be set after the import. Click **Import** and close the dialog box.
5. Fit the view and change the feature definition to *Meshes/EX_TERR_Ground*

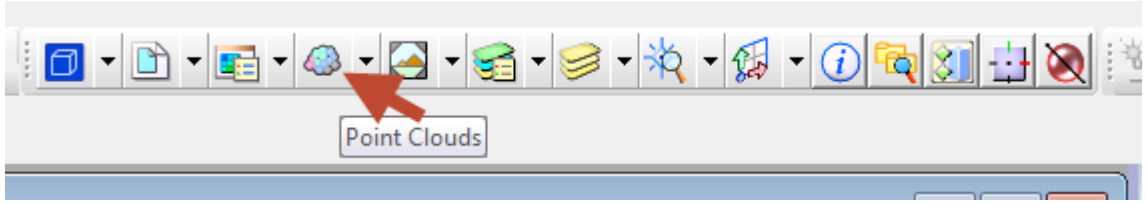




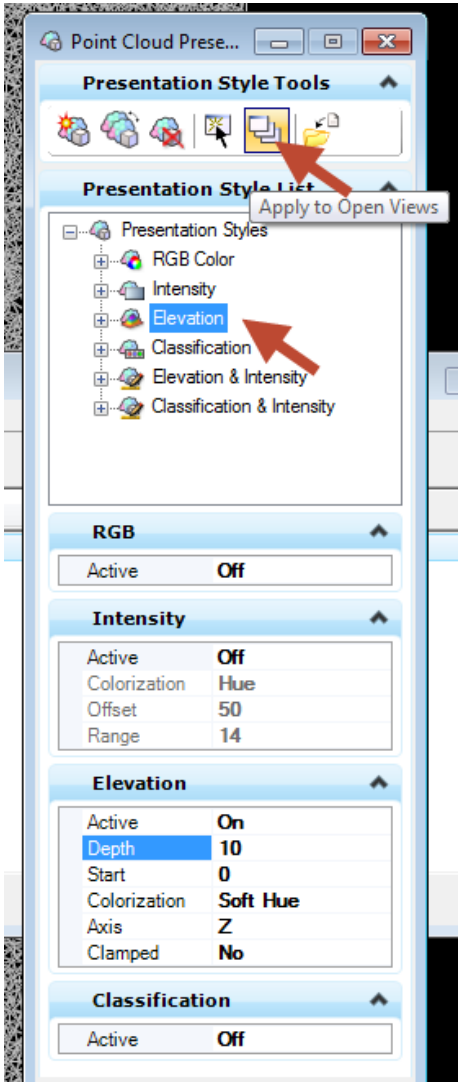


2.1.4 Create from the Point Cloud tools using a "LAS file"

This method will be used when importing a very large LAS file. While OpenRoads can handle a larger amount of surface data then a traditional InRoads DTM it still has a breaking point. The point cloud tools will be used to filter out unneeded areas of the LAS file data before importing to a terrain.

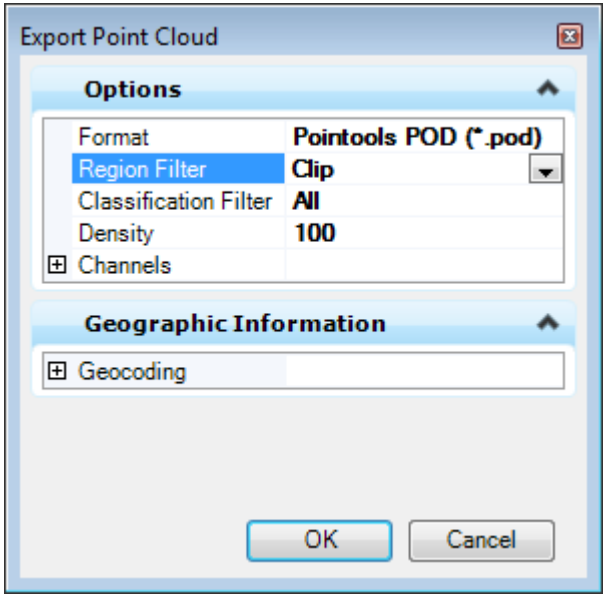


1. On the MicroStation Primary Tool bar select the Point Clouds Icon. On the Point Cloud Dialog Box select the Attach Icon. Browse to and select the LAS file.
2. In the Bentley Point Clouds dialogue box select *Settings > Presentation*.
3. Highlight the Elevation and set as needed. Click on the Apply to Open Views button to visualizethe existing ground surface and close the Presentation dialogue box.

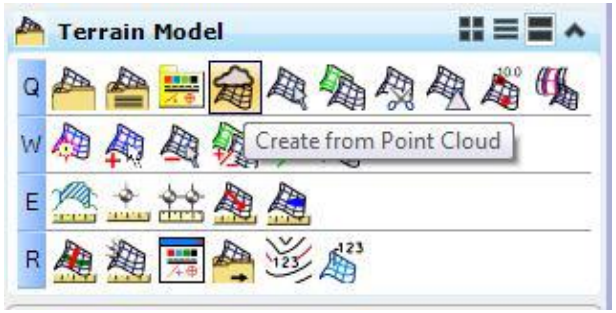


4. In the Point clouds Dialog box use the Clip tool to clip out the unwanted area. Keep in mind this only clips what you see on the view display, the actual points are still in the cloud. To get rid of these points select *File > Convert.* Change the Region filter to Clip and click OK. Follow the prompts to create a new POD file.

5. The Create from POD file tool in OpenRoads will bring in the entire POD regardless of what is clipped out of the view display. To only bring in the needed area attach the new smaller POD file and detach the original.



5. After visualizing the existing surface with the POD file, the Terrain Model can be created. From the Terrain Models task pane select Create from Point Cloud.



6. Set as shown.

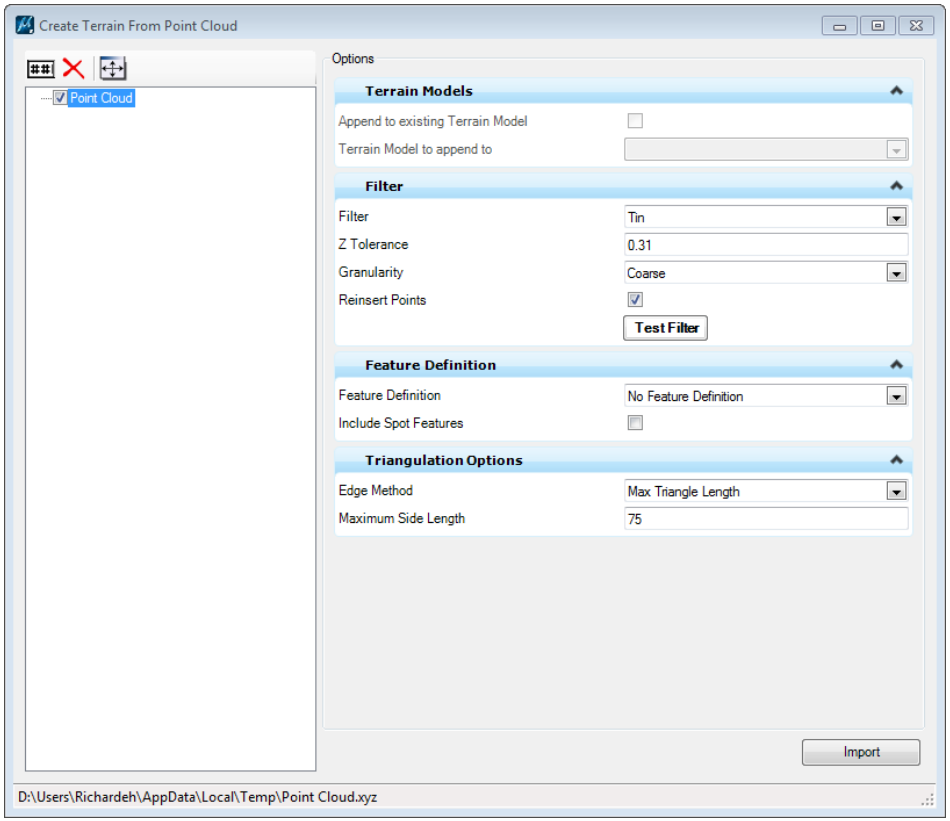
BENTLEY SUGGESTED SETTINGS FOR POD FILE IMPORT

In the Import Terrain Model From Point Cloud dialogue box

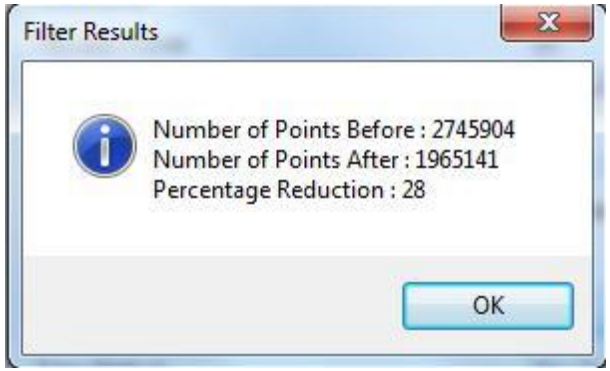
- Always use the "Tin Filter".
- Input the "Z" Tolerance.
- Always use the "Coarse" option.
- Always use "Reinsert Points" option.
- Do not select a Feature Definition until after the Terrain Model is created.

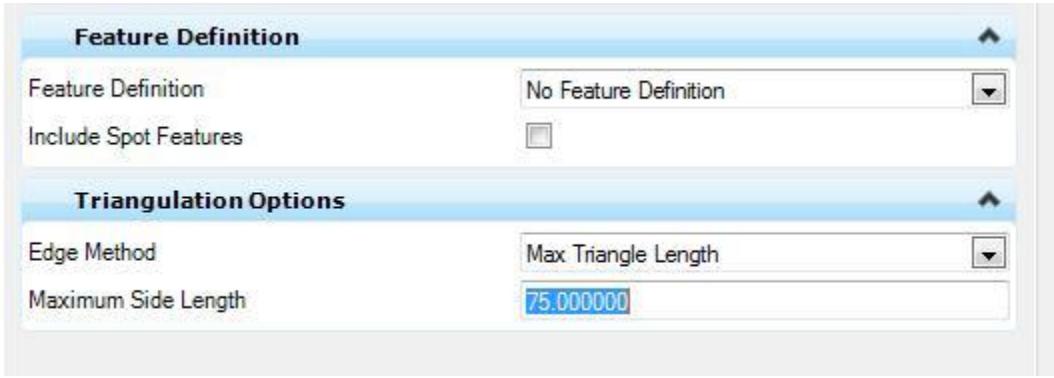
What is the "Z Tolerance"

- An unaltered TIN (no filtering) will produce a huge file that could be difficult to work with. The Z tolerance is the amount of error that you are willing to accept in order to produce a TIN that is not too large to use.
- Bentley reports that if you want to be absolutely sure that your final filtered TIN is within a certain accuracy of your original unfiltered TIN then Z tolerance should be ½ of that acceptable error (vertical accuracy).
- The Survey Report should give you an idea of the vertical accuracy within a point cloud at a 95% confidence level.

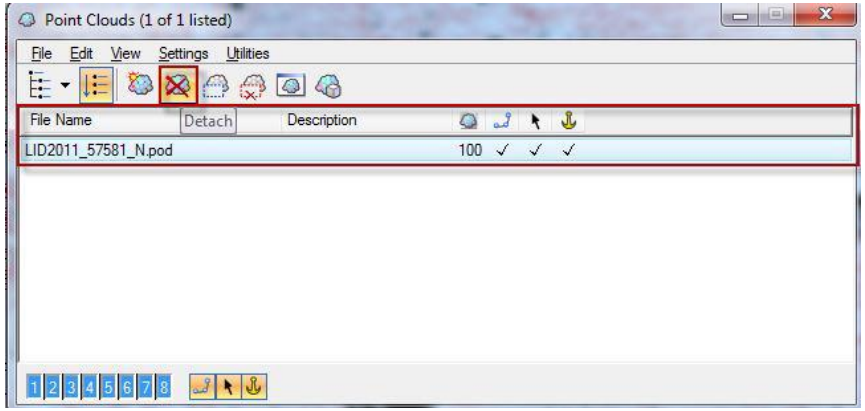


6. Select the Test Filter button
   The "Test Filter" button allows you to test various settings before actually creating the Terrain Model. Default Triangulation Options can be changed here, before the Terrain Model is created.





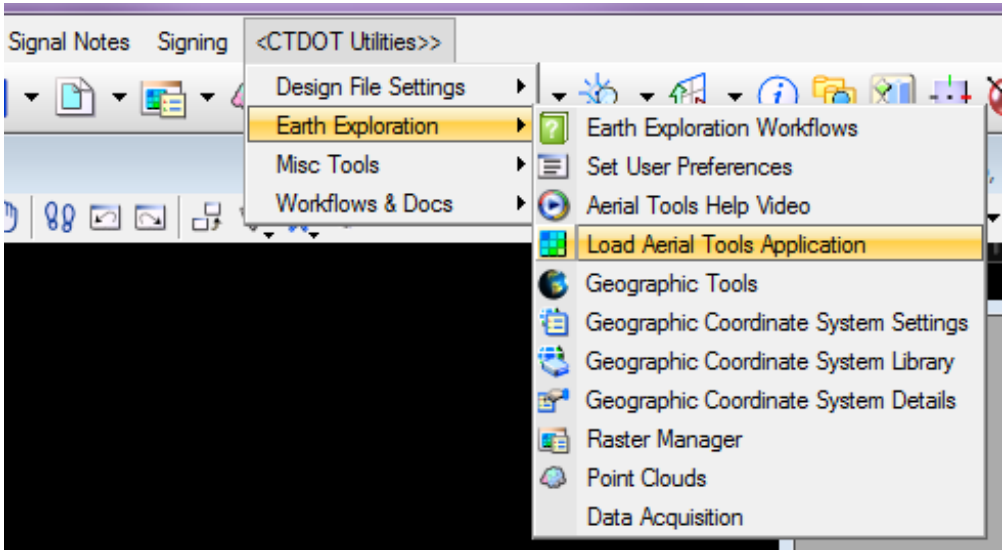
7. After the Terrain Model has been created. The POD File is no longer needed and can be detached from the design file.

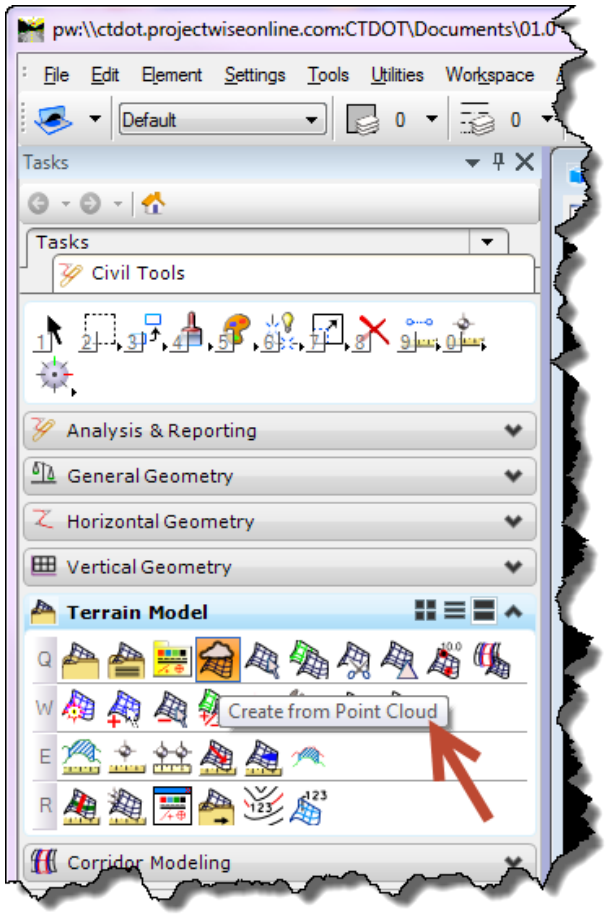


8. Fit the view and change the feature definition to *Meshes/EX_TERR_Ground*

2.1.5 Create from Point Cloud tools using Earth Exploration

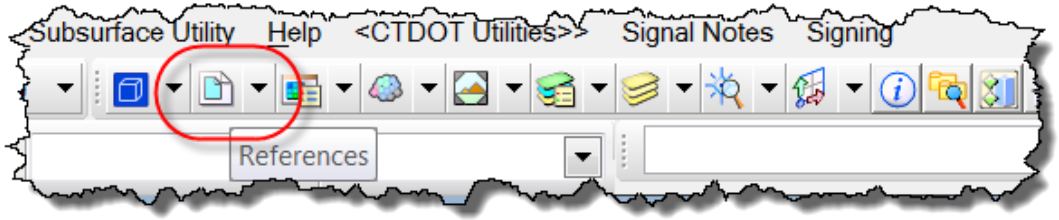
If you are in the preliminary stages and do not have an official survey yet you can use the Earth Exploration Tools provided with the workspace. These tools will aid you in loading aerial photography and Point Clouds in to a MicroStation file. The Point Clouds can then be imported in to OpenRoads to create an existing terrain.



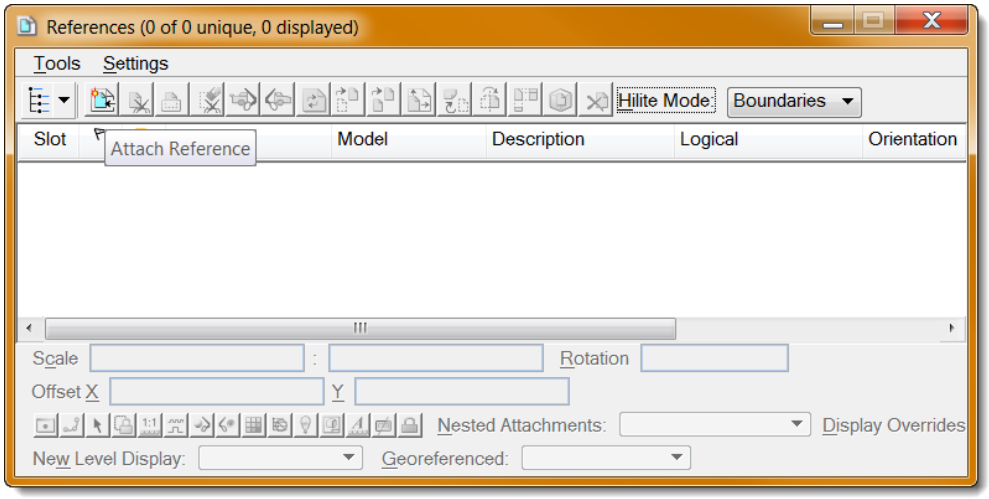


Section 2.2 Reference in the Existing Terrain

1. If you have not done so already create a 2D design file as shown in Chapter, 1 Steps 6 and right click and select Open With, select the *OpenRoads SS4* option.
2. Once in the file go to the Reference tool and open the references dialog box.

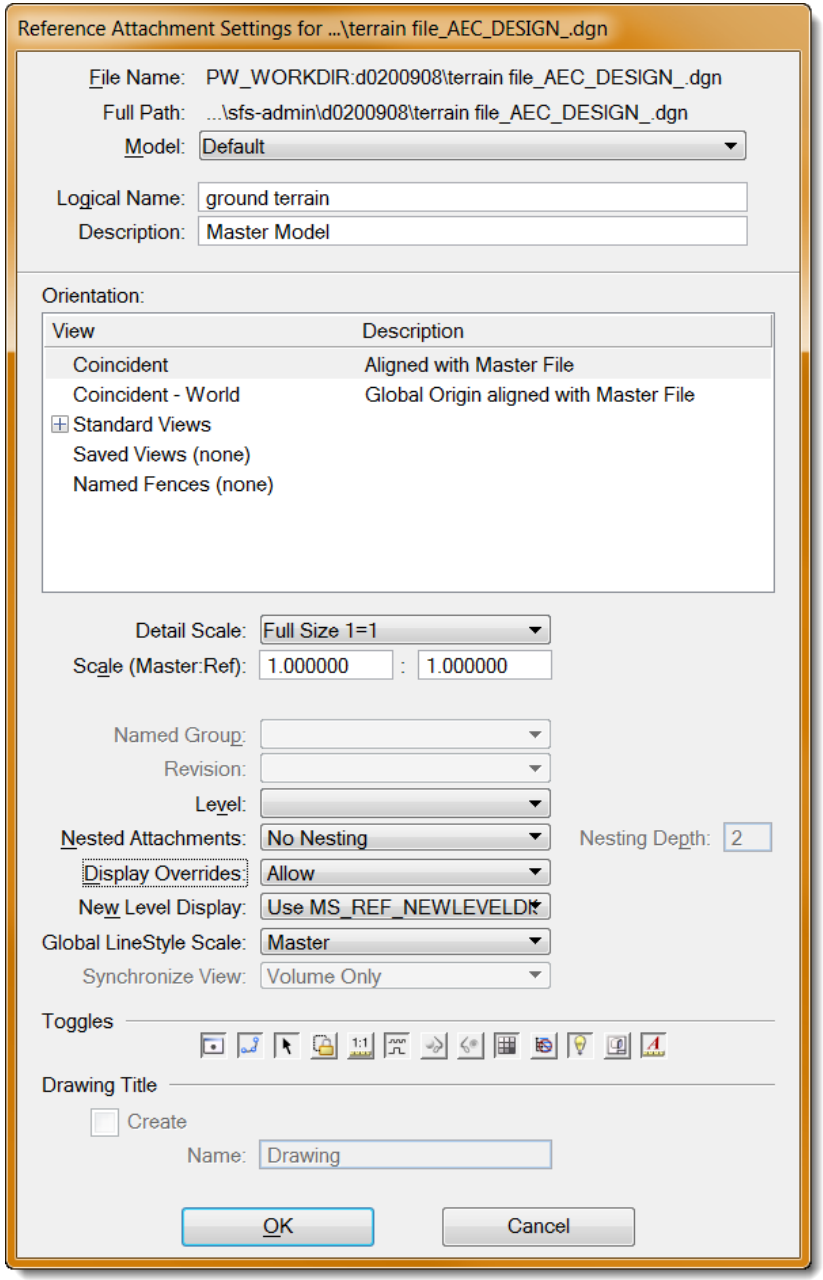


3. In the references dialog click the Attach Reference button.

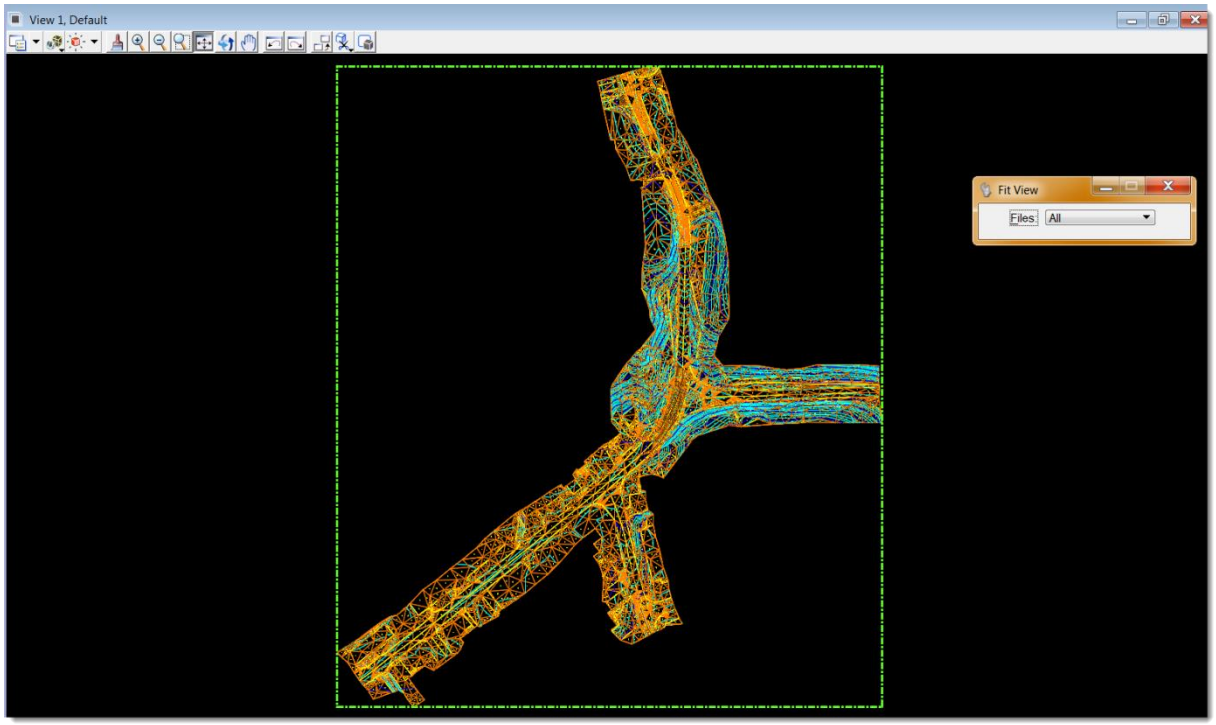


4. In the Attach Reference dialog box browse to the needed DGN terrain file. If Survey created it, the file will be in the *500_Pre_Design\03_Central_Survey folder*. Highlight it and click OK.

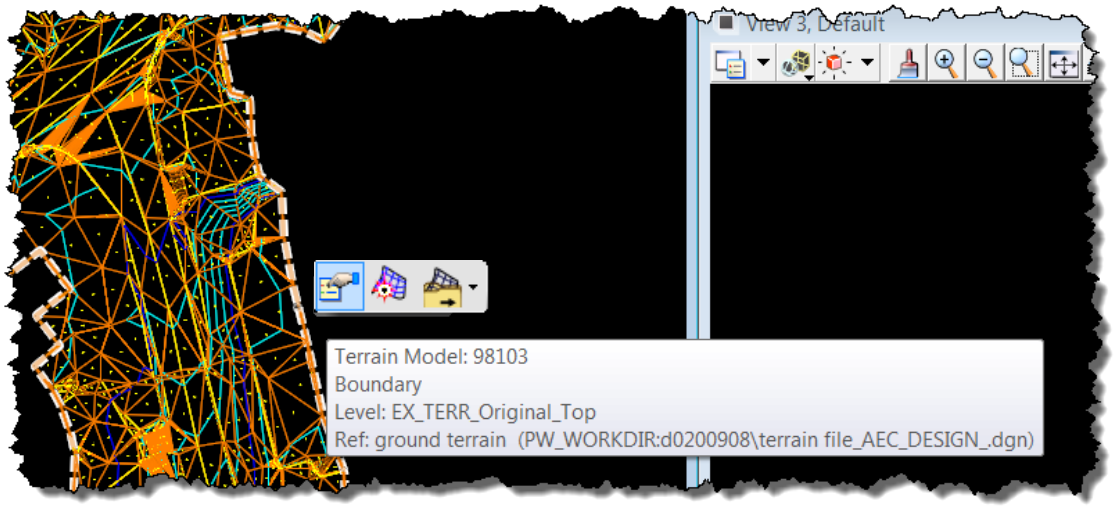
5. In the Reference Attachment Settings Dialog Box give the file a logical name, set the options as shown and click Ok.



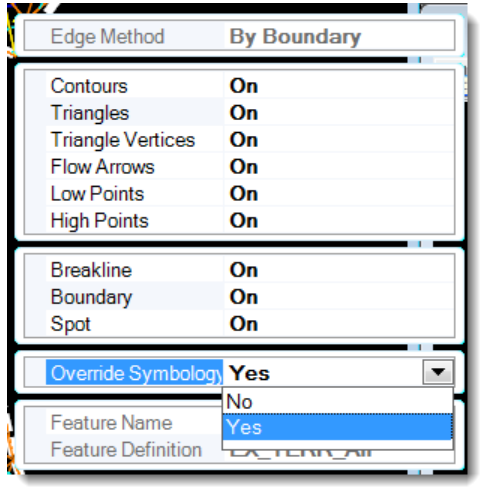
6. Go to your main view and click **Fit View**. The terrain should be displayed.

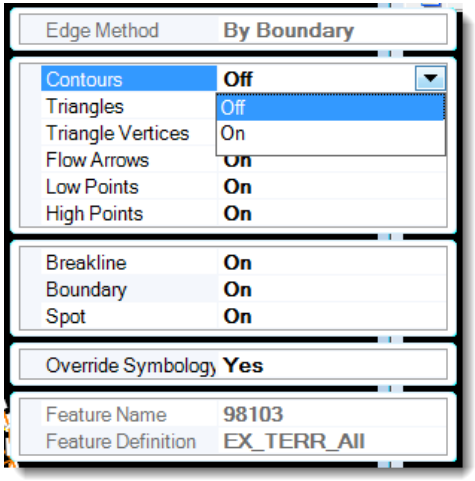


7. To change the display of the view select the **Element Selection Tool** and click and hover over the terrain border (edge) to get the context menu to appear. Click the **Properties** button.



8. In the Override *Symbology field* select Yes to be able to change the display of features in the terrain model.
9. Now select Off for all of the fields you would like to display off such as flow arrows, low points etc.
10. The terrain model should now display with symbology turned off. The example below shows only the triangles and boundary turned on.



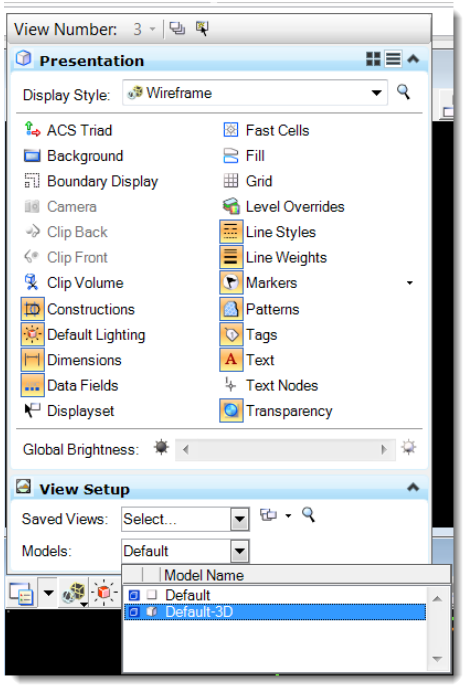


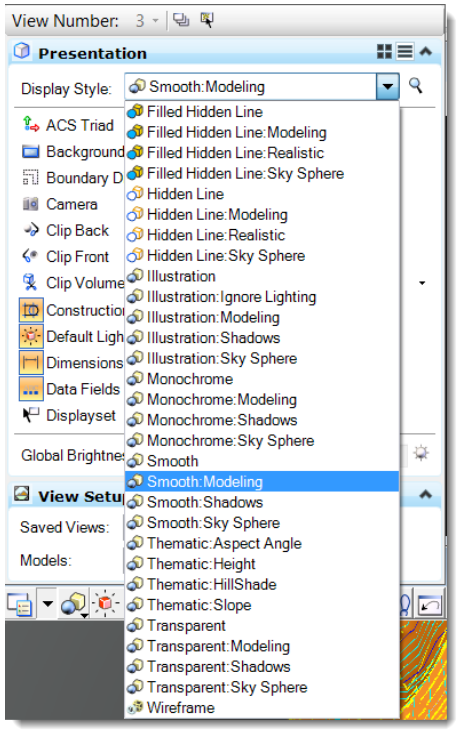
11. Now hover over the terrain model edge again to get the context menu to appear. Click the Set As Active Terrain Model button.

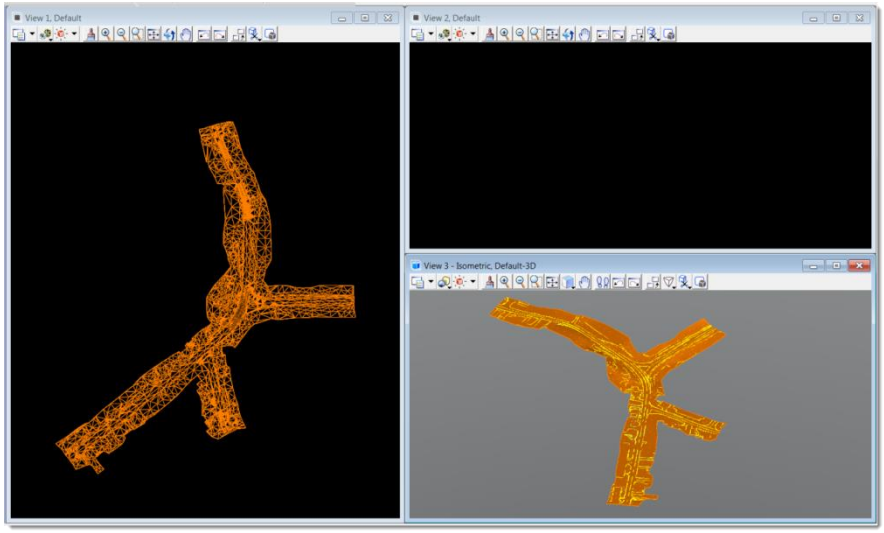
Section 2.3 View the 3D Features

The quickest way to do this is to select F9 on your Key board, but it is important to understand how this all happens. Follow the instructions below to view your 2D features and 3D features in the same DGN file.

1. Open another view window. In this window open the View Attributes and select the default-3D model from the model field.
2. To make it a bit easier to see, in the display style field select Smooth Modeling from the dropdown list
3. Click the Fit View button in your view containing the default model and your view containing the default-3D model. Use the Rotate View command see your terrain in 3D. Most of the modeling will be completed in the 2D window, the 3D view is useful for evaluating changes to the design visually.



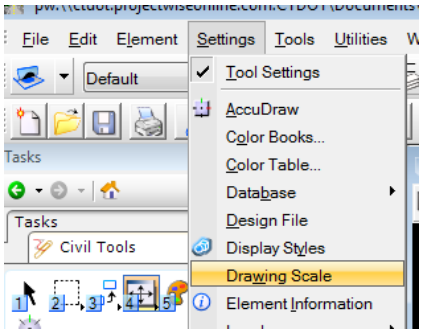


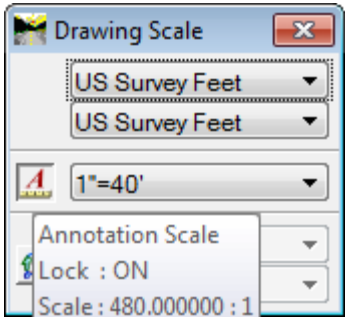


Chapter 3 Geometry

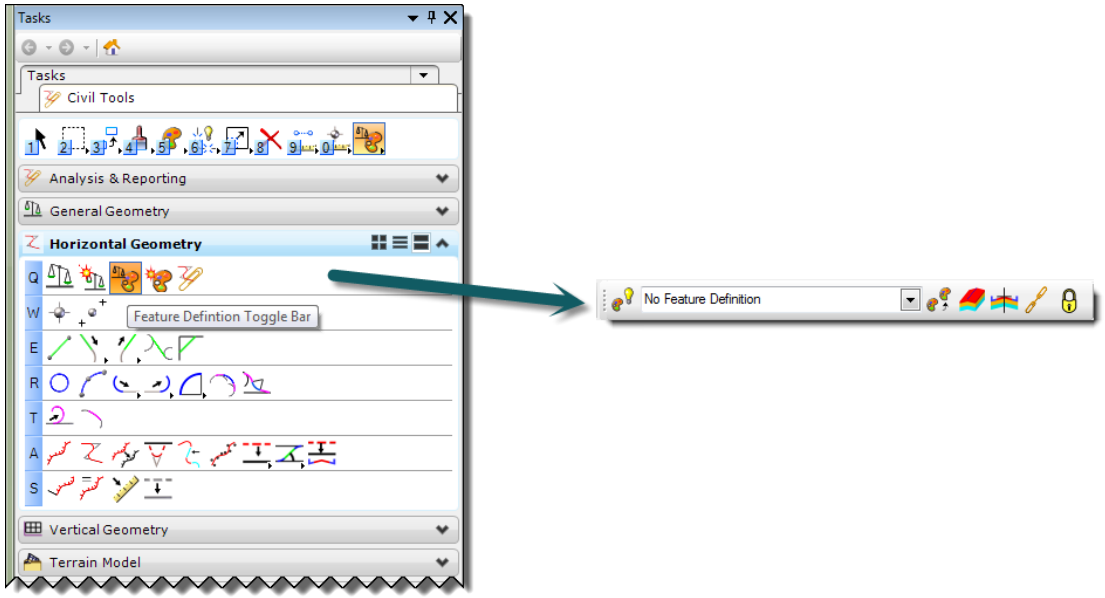
Section 3.1 Geometry Set Up

1. To set the Annotation Scale, go to *Settings>Drawing Scale*. Toggle Annotation Scale On and set it to 1" = 40 '.

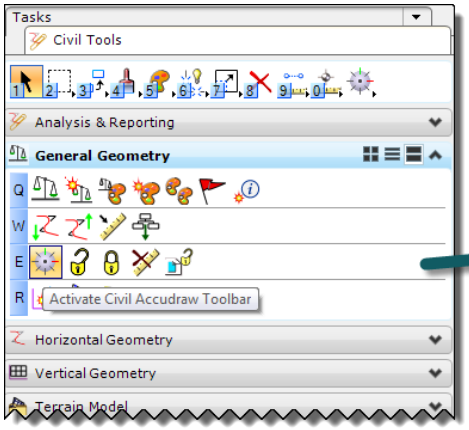




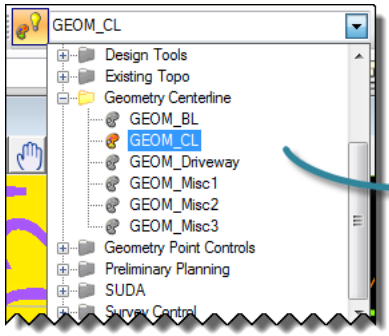
2. Go to *Tasks>Civil Tools> General Geometry* and turn on the Feature Definition Toggle Bar (if it is not already on).



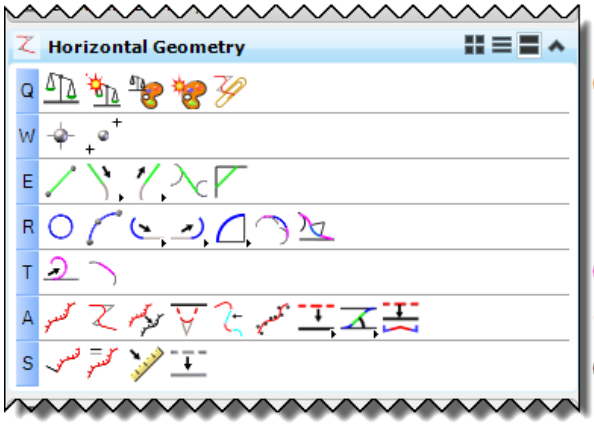
3. Go to *tasks>civil tools>general geometry* and turn on the Civil Accudraw toggle bar (but do not turn Civil Accudraw on yet).



4. Set the feature definition to *GEOM_CL* and make sure the Use Active Feature Definition button is on.



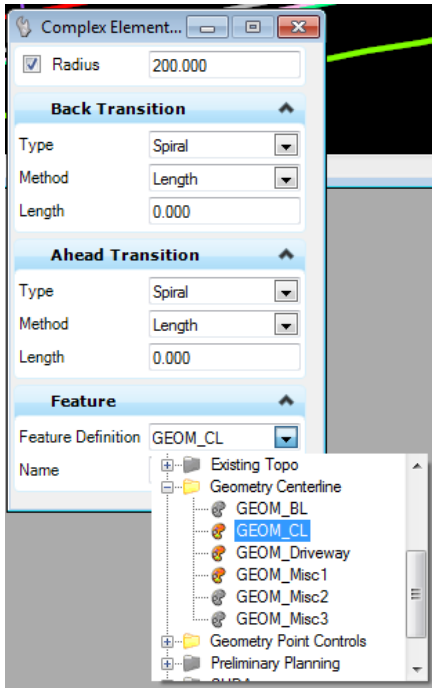
5. Review the horizontal alignment tools.



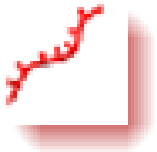
General Geometry
Geometry Point
Geometry Line
Geometry Arc
Geometry Spriral
Geometry Complex
Geometry Modify

Section 3.2 Creating Horizontal Geometry from PI's

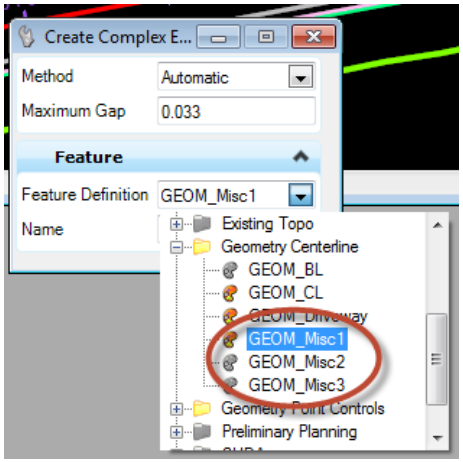
If you use the Complex By PI method the alignment will be one element rather than multiple pieces, however you cannot add PI's after the fact. Use the Feature Style *Geometry Centerline/GEOM_CL*. This style will appear with stationing turned on.

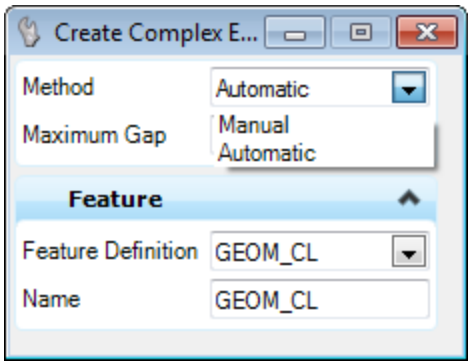


Section 3.3 Creating Horizontal Geometry from Elements



This method has a bit more flexibility with layout but you will need to use **Complex By Elements** after to create a single element. The issue with this method is if stationing is part of the feature definition annotation (as seen in *GEOM_CL*) the old stationing for the individual elements will display in addition to the new stationing for the complex element. To solve this issue the user can use a different feature definition for the initial layout and then set the *GEOM_CL* feature definition before using the Complex By Elements command.





If using the *Automatic* method, select the first element in the alignment and indicate the direction, the rest of the alignment should select automatically. Click to accept the complex.

If using the *Manual* method, select each individual element in the alignment (from start location to end) and right click to finish and accept the complex.

Section 3.4 Civil Accudraw

The Basics of Civil AccuDraw

Why You Need Civil AccuDraw

Using Civil AccuDraw to Communicate Design Intent

The process for laying out side road elements is similar to main alignments but for added functionality/ intelligence to the elements the Civil Accudraw feature will be used. *Note: Make sure you turn off regular Accudraw when using Civil Accudraw.

When using Civil Accudraw keep in mind which snaps are used and which fields are locked when placing the geometry, both will determine how the second alignment interacts with the first when it is adjusted.

For the regular snaps here are a few examples:
Perpendicular snap will keep the alignment attached to the first at a right angle, if no station is entered in the process it will move around the alignment.

Key Point snap: this will make an element tied to the element that is selected, for example if I draw one line and key point snap my second alignment to this item, no matter where I move the first end point the start point of the line attached will follow.

Civil Accudraw "snaps" explained :

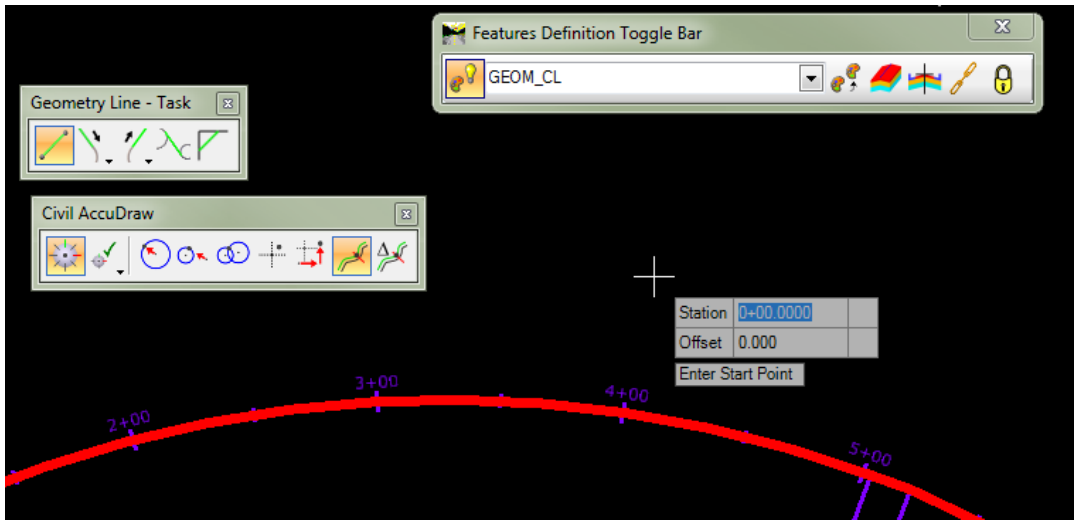
- Distance-Direction: a feature end point is located based on a given distance and direction
- Distance Direction Unlinked: (need a better explanation)
- Distance- Distance: feature is dependent on two defined distances, usually from a specific feature.
- XY: feature is defined and tied to a specific XY location
- Delta XY: feature is defined and tied to a specific point given a X and or Y offset from the given point

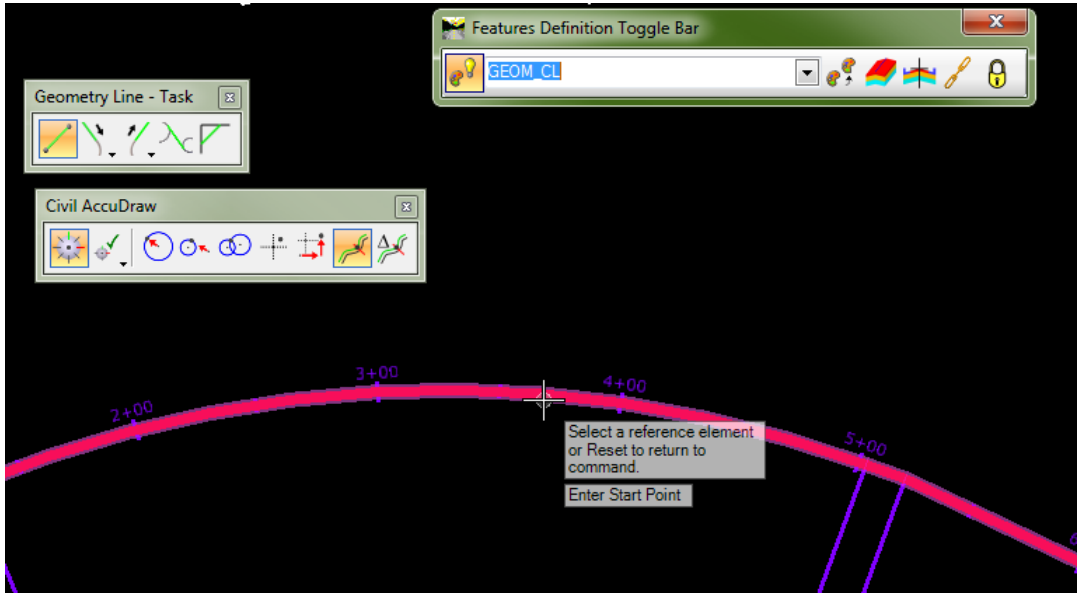
- Station-Offset: feature is defined by a start specified by a station and offset from a given feature, and then has an end point defined by station offset or some other snap type depending on the requirement of the designer
- Delta Station Offset: feature is defined by an offset from a chosen Station-Offset as above.

Section 3.5 Creating Secondary Alignments with Design Intent

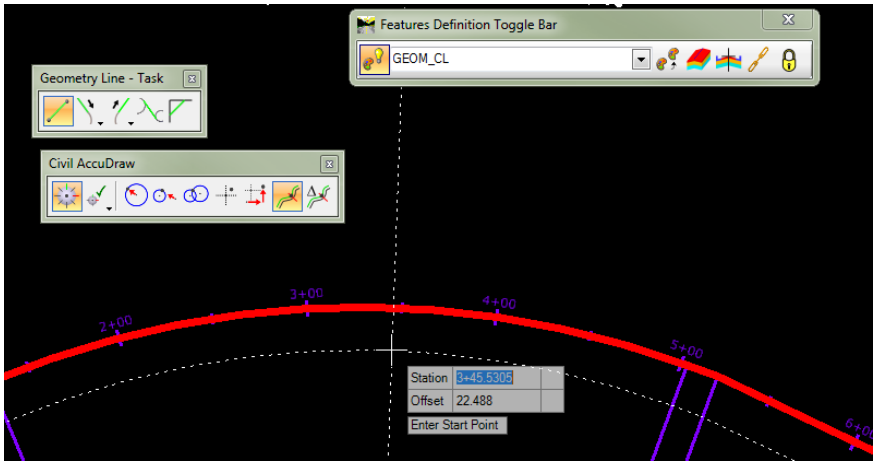
Try the following method to lock the Secondary alignment to the Main alignment.

1. Toggle on Civil Accudraw and set the Civil Accudraw snap type to Station-Offset.
2. Select a geometry tool: Line, Arc, Complex By PI, etc. A heads up menu should appear when the cursor is on the screen, prompting for a station.
3. Key in the letter *O*. A prompt to select a reference element should appear. Left click the *Main alignment*.

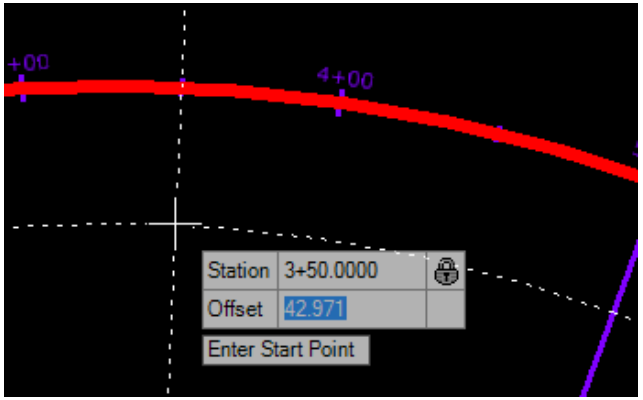


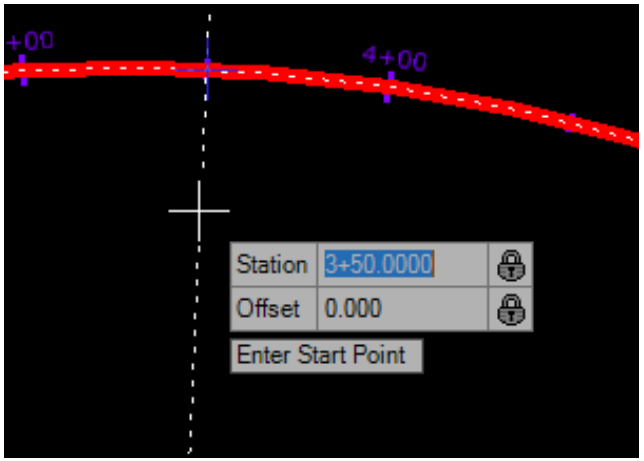


4. The stationing in the heads up prompt will now be stationing specific to the reference element, i.e. if the stationing runs from 1+00 to 3+00 those will be available, or 500+00 to 600+00 if the stationing was set differently. Key in a *station* on the element and hit enter. A small lock icon should appear to the right of the station field.



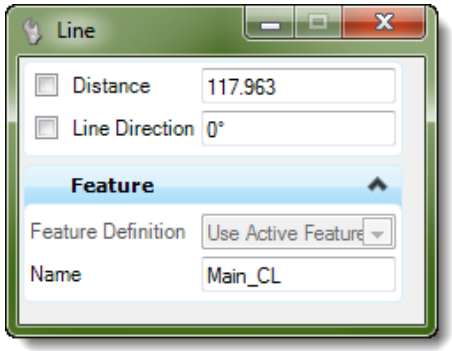
5. The cursor should now be in the *offset* field. Key in *0* (zero) and hit Enter. The lock icon should appear to the right of this field as well. A small blue crosshair should now be at the intersection of the station chosen and offset distance. This ensures that the start of the secondary alignment will begin at the intersection of the main alignment. Left Click to accept the start point.





Section 3.6 Renaming Alignments

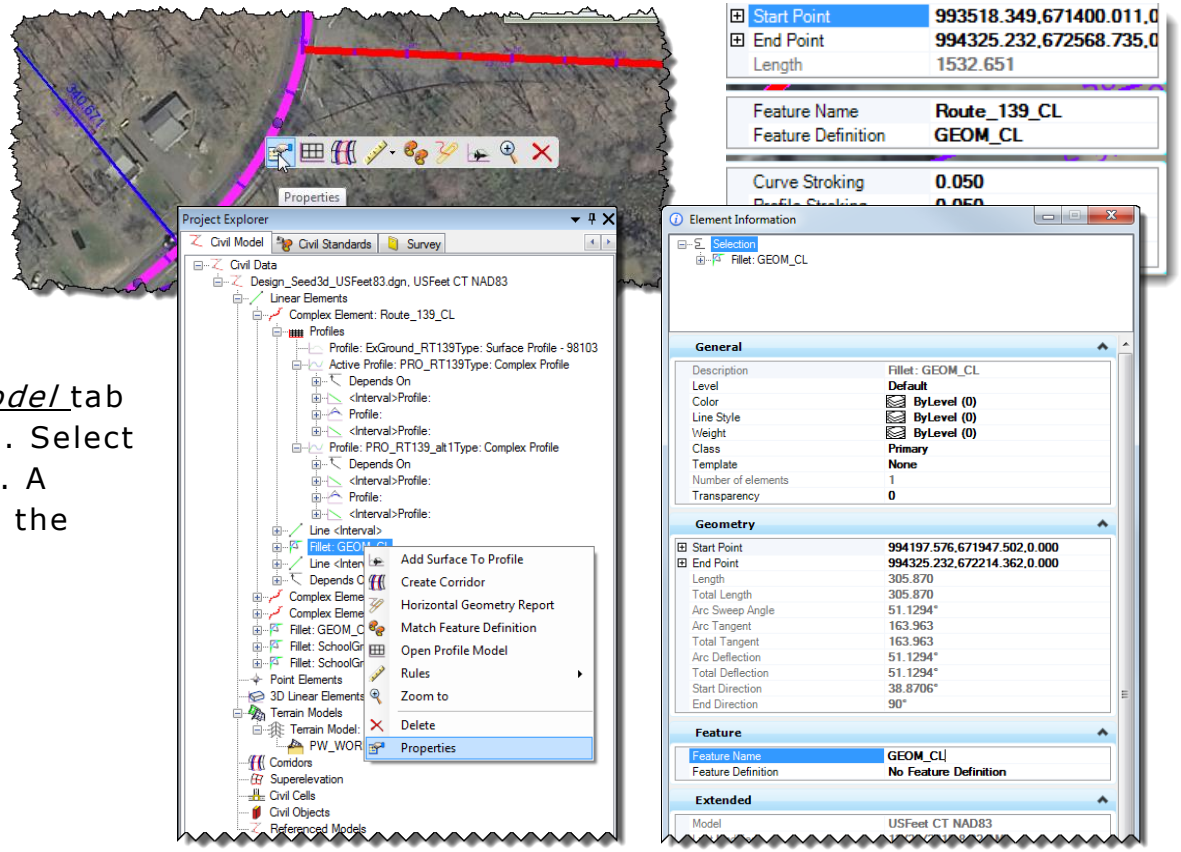
Geometry should be named when created; in the case of complex geometry the final complex element should be named. Individual components of a complex element can be named as well. Proper naming makes finding geometry in the Project Explorer much easier down the road.



There are multiple methods for naming elements.

1. **During element creation:**
   During element creation a dialog box will appear, a name can be entered into the *Name* field for each element created. This works for single elements and complex elements.

2. **Heads up menu:**
   Left click the element and hover over it. A heads up menu should appear. Select the **Properties** command. A *properties table* will appear, change the name in the *Feature Name* field.



3. **Project Explorer:**
   Go to the *Project Explorer> Civil Model* tab and right click on the element name. Select *Properties* from the dropdown menu. A *properties* table will appear, change the name in the *Feature Name* field.

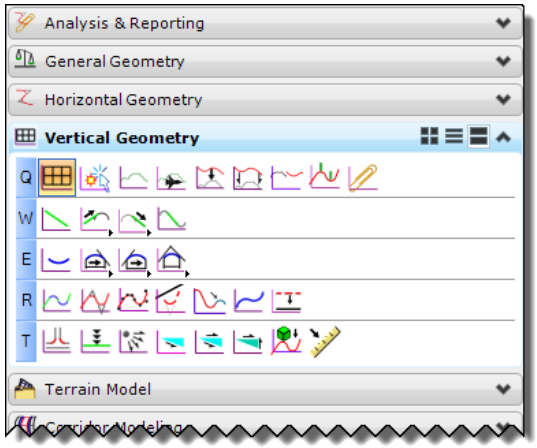
Section 3.7 Creating Vertical Geometry

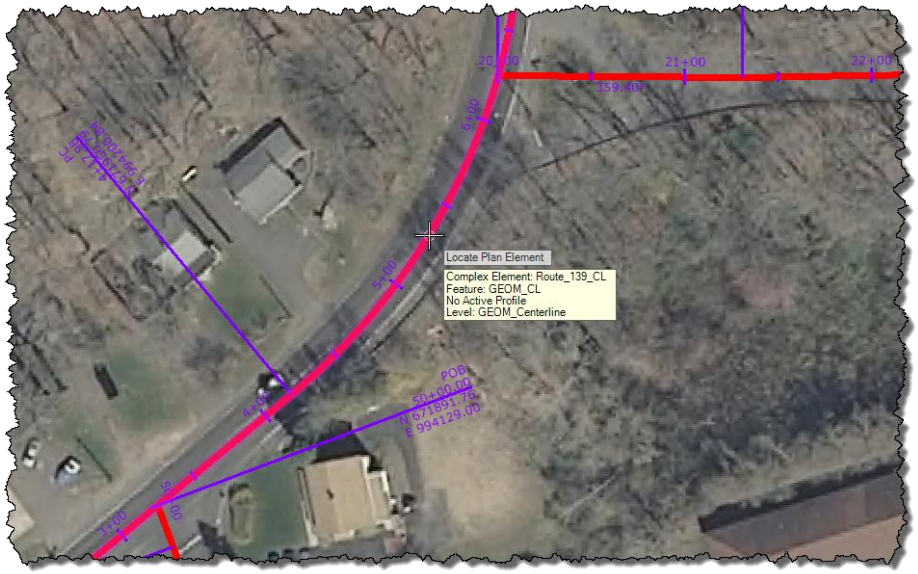
Creating Vertical Geometry from Elements

Creating Vertical Geometry from Known PI's

3.7.1 Displaying the Existing Ground

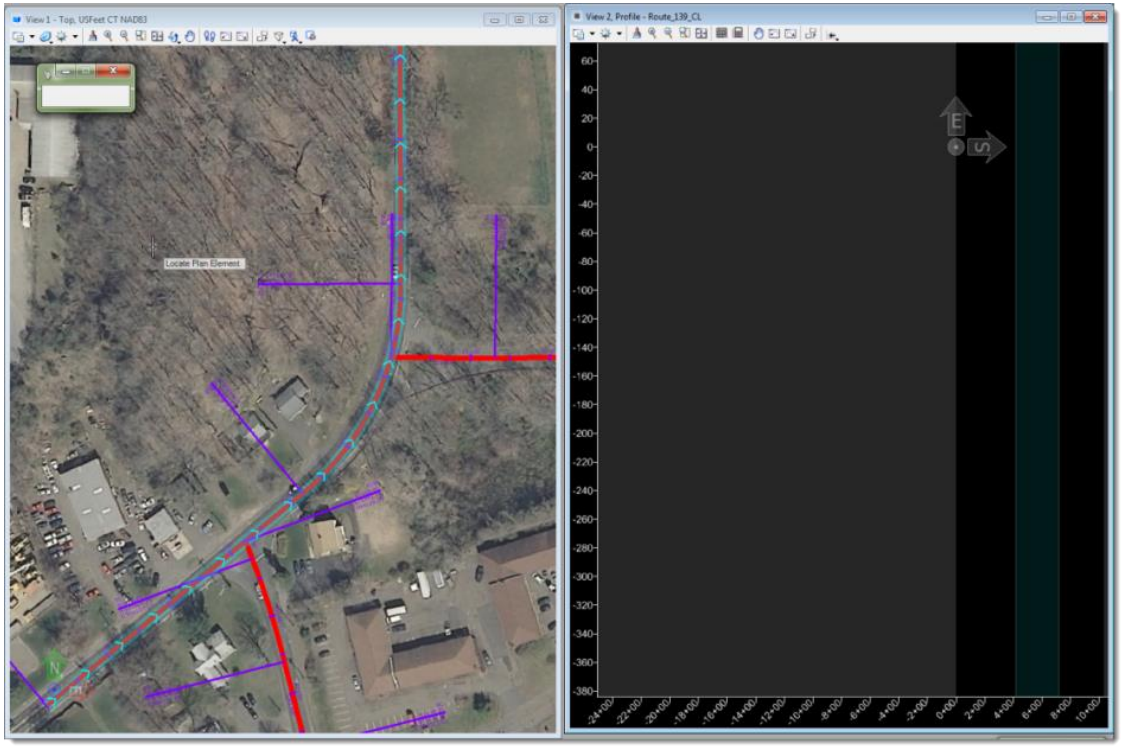
1. Open the profile view for the selected alignment. In *Tasks> Civil Tools> Vertical Geometry* select the Open Profile Model command. A prompt will then ask the user to *Locate Plan Element*, Left click to select the Element.



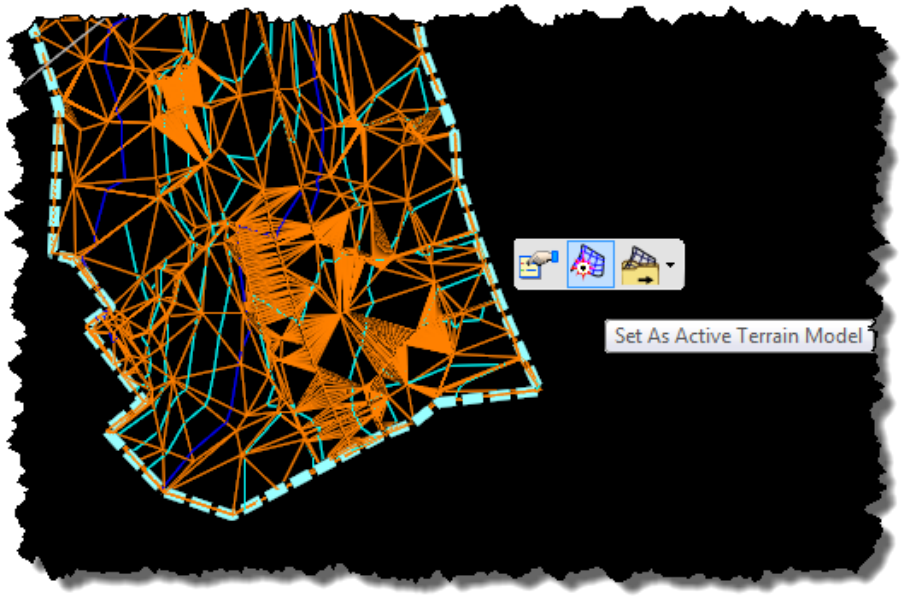


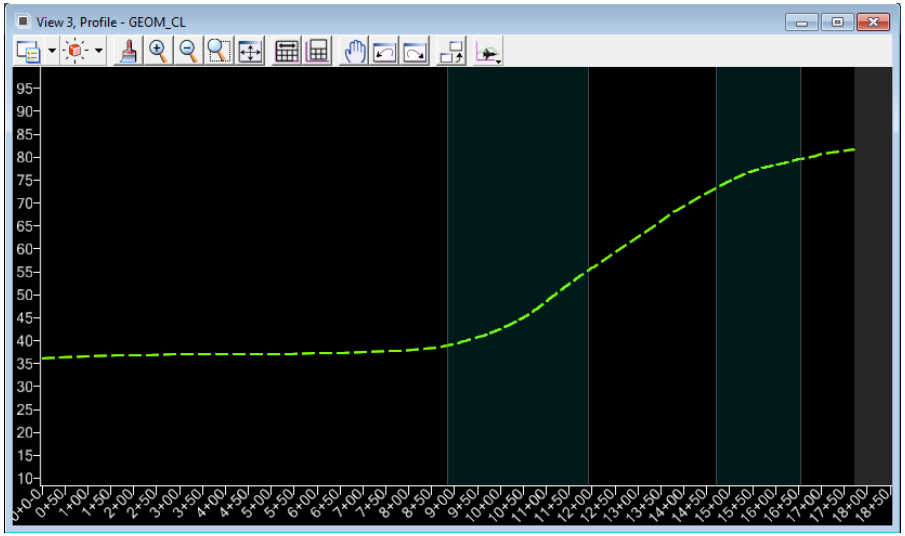
2. A prompt to *Select or Open View* will appear. Select an **unused view** from the view groups box.

3. Once the view opens, left click inside the view. An X and Y axis should appear in the profile view and the alignment will be highlighted blue with chevrons in the plan view. This indicates which alignment is in the active profile view.



4. Display the existing surface on the profile model. Select the ground terrain model and hover to get the context menu to appear. Click the Set Active Terrain model command. The terrain profile should appear in the profile view.

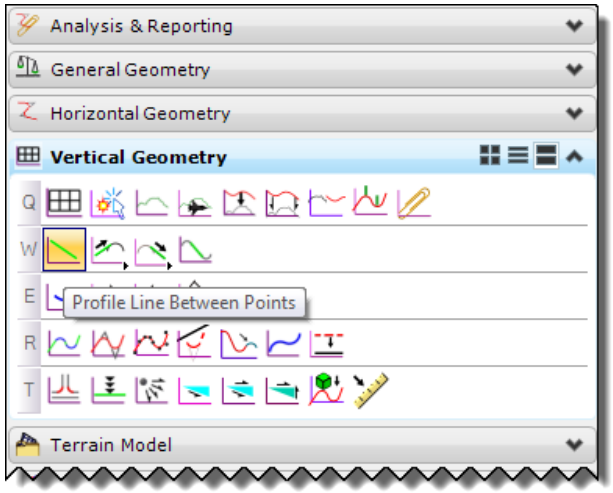




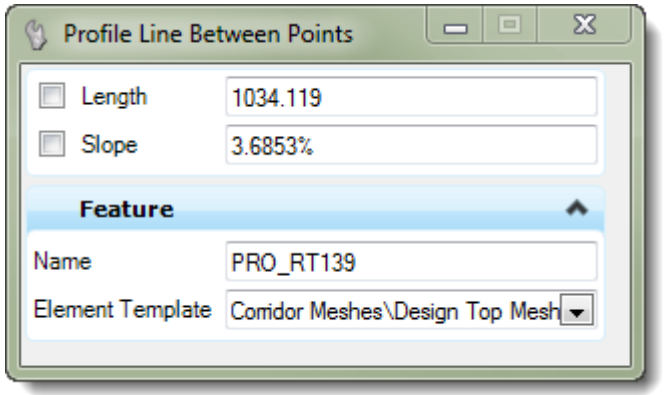
3.7.2 Creating a proposed Profile

This example will show how to create a very simple proposed profile. See the Bentley tutorials for more a detailed explanation of the vertical geometry tools.

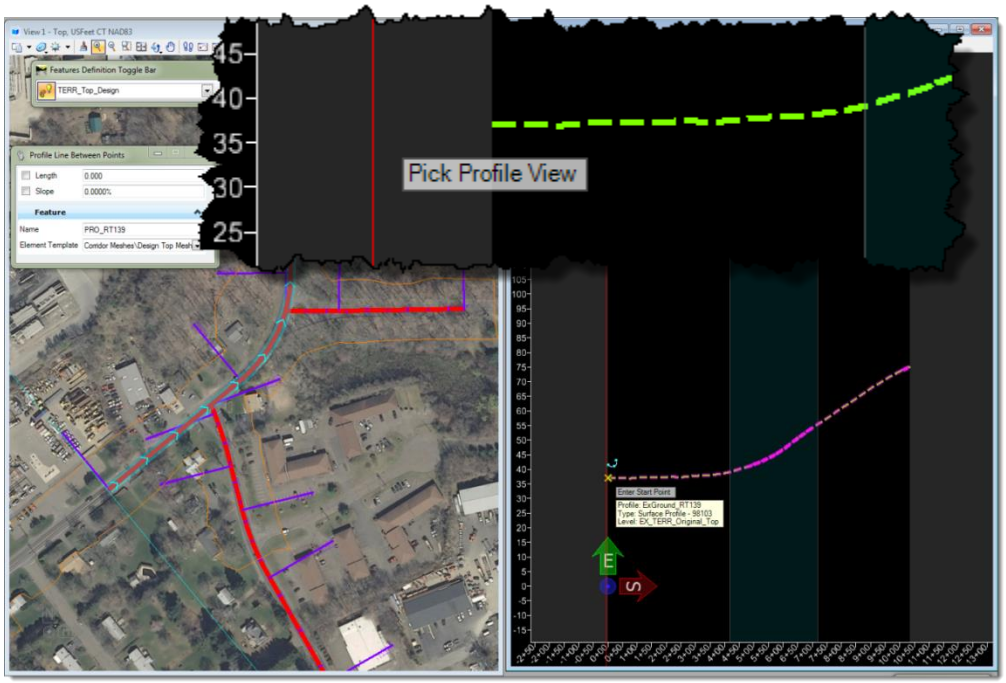
1. Go to *Tasks> Civil Tools> Vertical Geometry* and select the Profile Line Between Points command.



2. The Profile Line Between Points dialog box will appear. Fill in the Name field (something that will help identify the profile later).

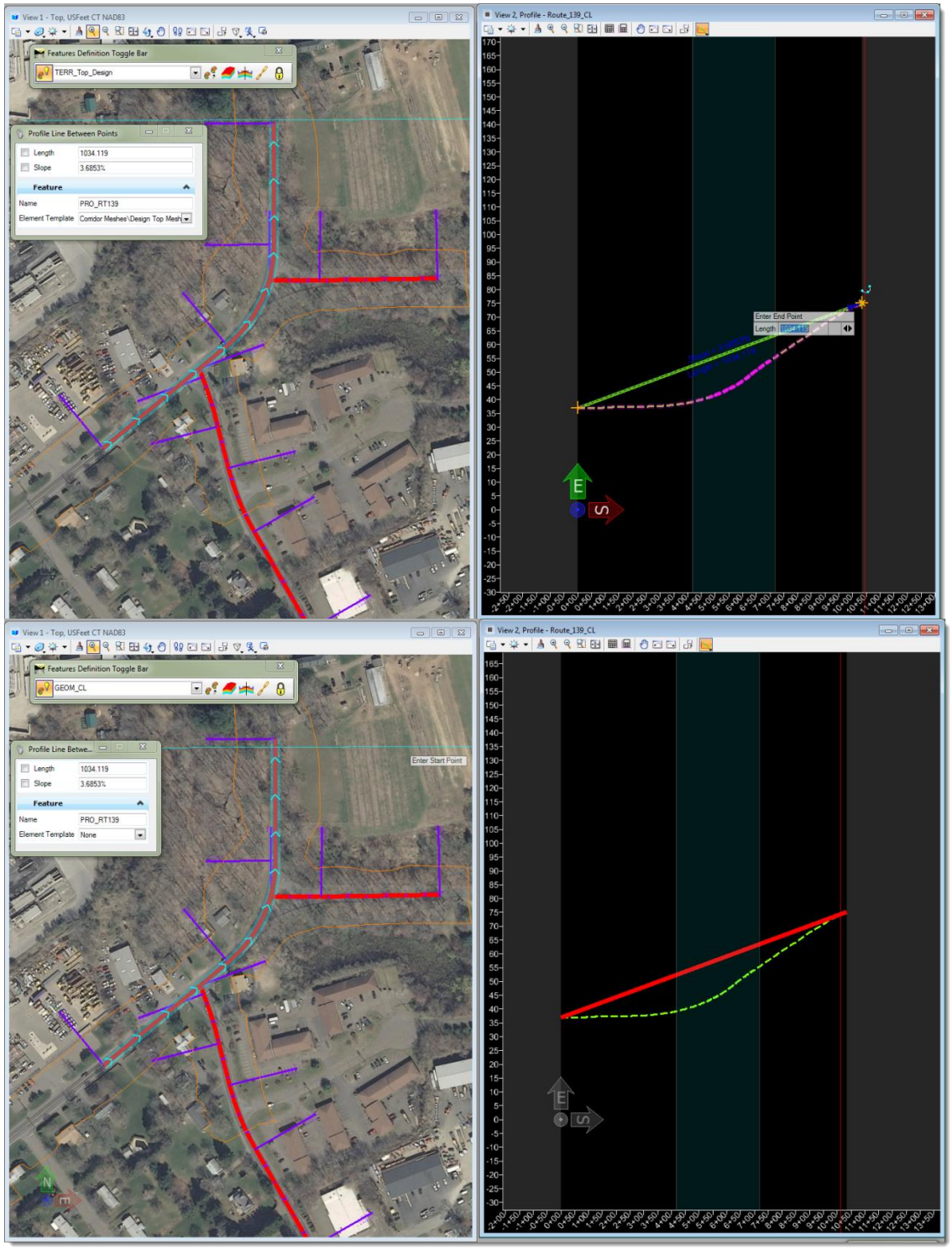


3. A prompt to *Pick Profile View* will appear, left click in the view window with the active profile (the one that has the existing ground displayed). Ther *Enter Start Point* prompt will appear. In the profile view select **your starting point**, a blue perpendicular line in the Plan view shows represents the location of the start point. (In this example the end point of the exisitng ground was selected to tie the proposed alignment in with the existing ground.)

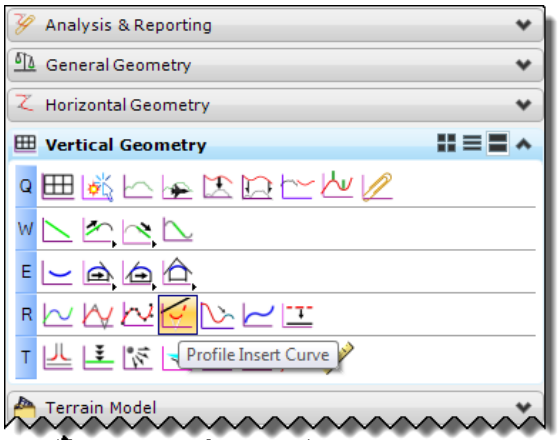


4. The next prompt is *Enter End Point*. In profile view select the **end point**, it will also be displayed in plan view with a perpendicular line.

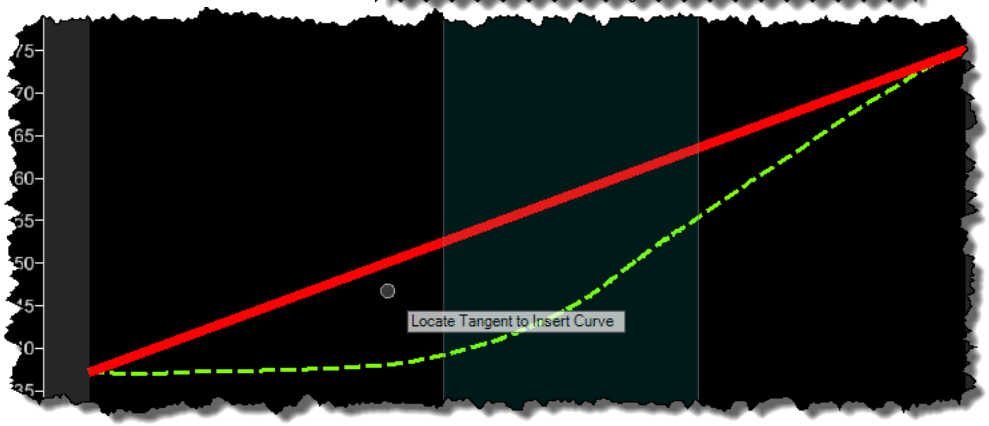
5. The feature definition can be changed to make it easier to distinguish profile alternatives.



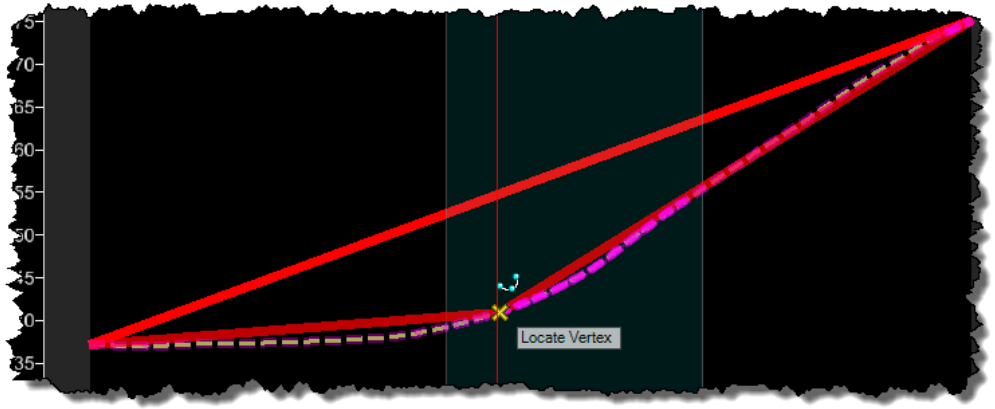
6. Add curves into the profile. Go to *Tasks> Civil Tools> Vertical Geometry* and select the **Profile Insert Curve** command.



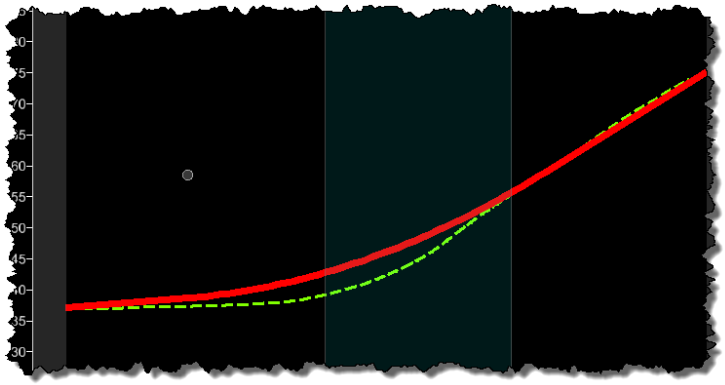
7. A *Locate Tangent to Insert Curve* prompt will appear. Left click to select the **profile line**.

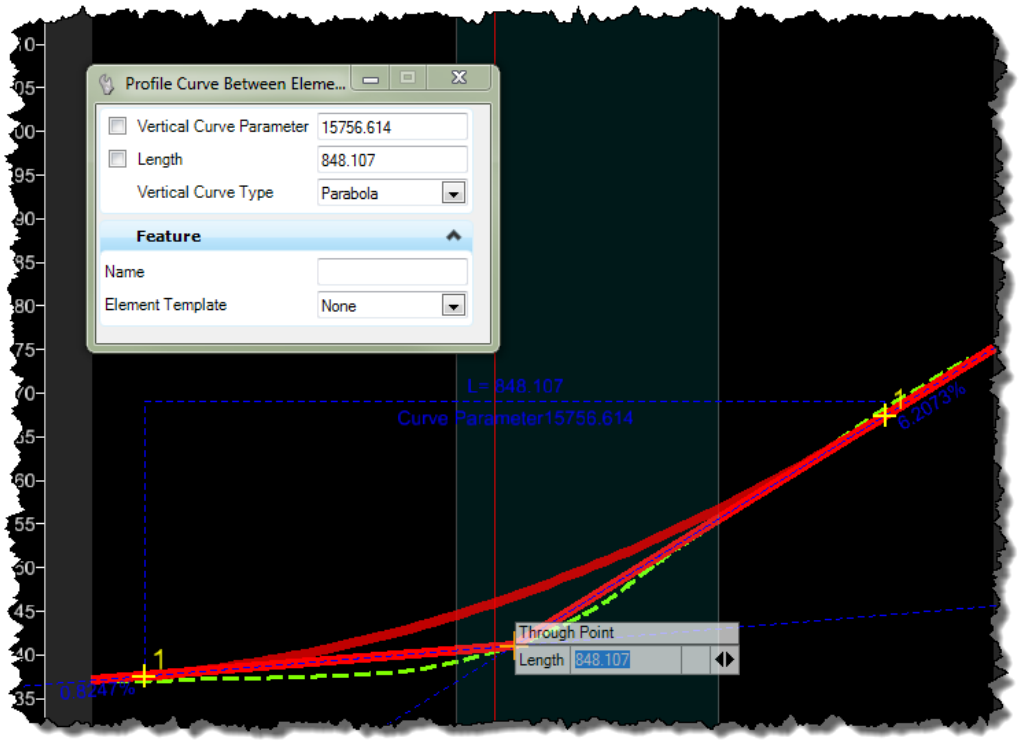


8. The next prompt is *Locate Vertex*. Left click to select a **vertex point** for the curve.



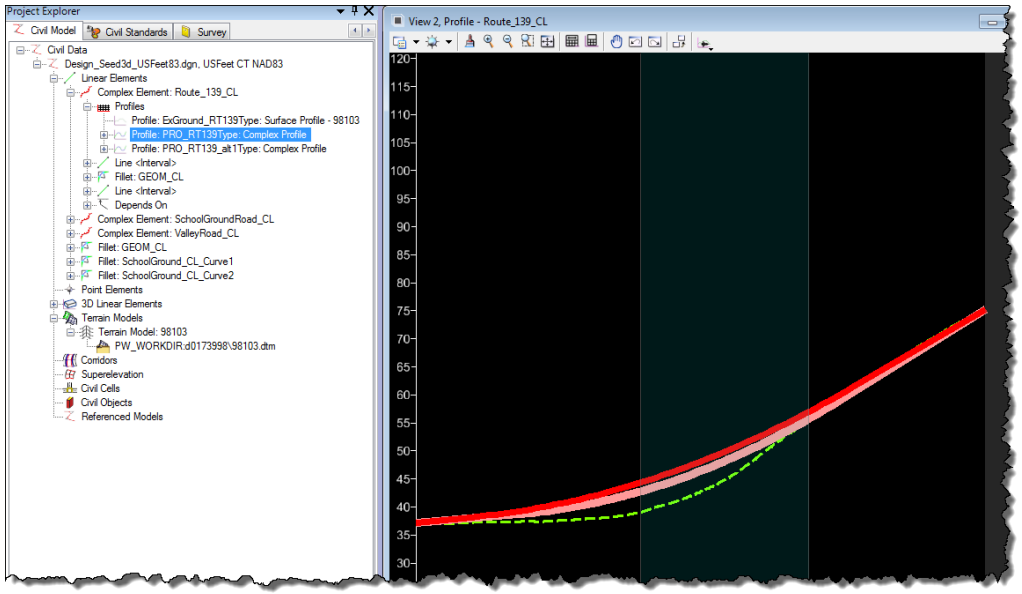
9. It will now prompt for a *Through Point*. Make sure the Vertical Curve Parameter box is unchecked. Select a through point on the profile screen or by entering in a vertical curve parameter or length and left clicking through the heads up fields to accept. The proposed profile should now be displayed.





3.7.3 Vertical Alignment Alternatives

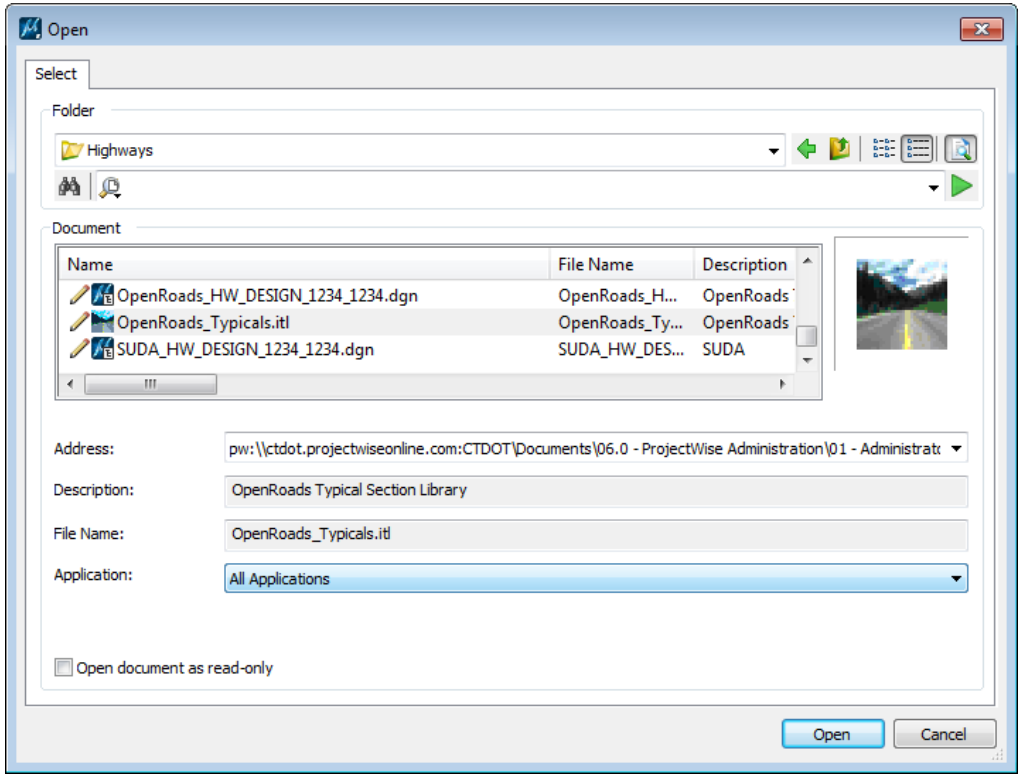
Multiple profile alternatives can be created on the same plan element. In this example there are two proposed profiles. It is here that properly naming elements is especially important. When selecting alternatives or comparing alignments, properly named elements will be much easier to identify in the project explorer, as well as identifying element dependencies.

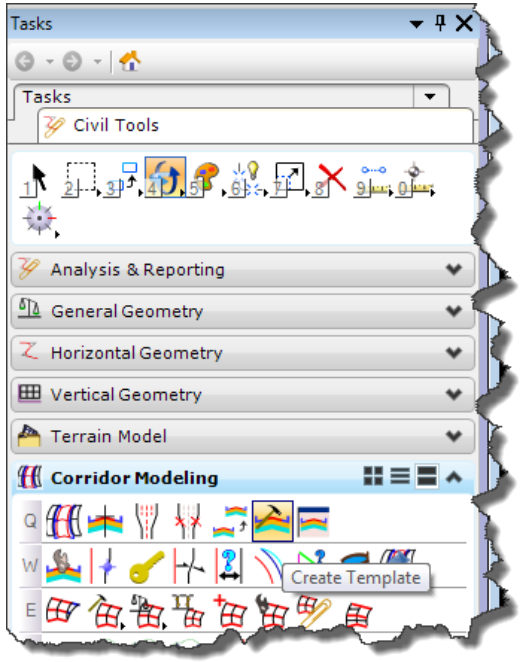


Chapter 4 Template Library

The Template Library will look very similar to what you were used to with InRoads SS2.

1. To open the Template library in the Workspace go to *Tasks > Civil Tools > Cooridor Modeling > Create Template*. The Create Template Dialog Box will open and the Template Library file on the Workspace will be pointed to as read only.
2. If you would like to make modifications to the Templates select *File > Open* and open the Template Library file that you copied over in the getting started section on this manual. Click on the *ITL* and Select Open



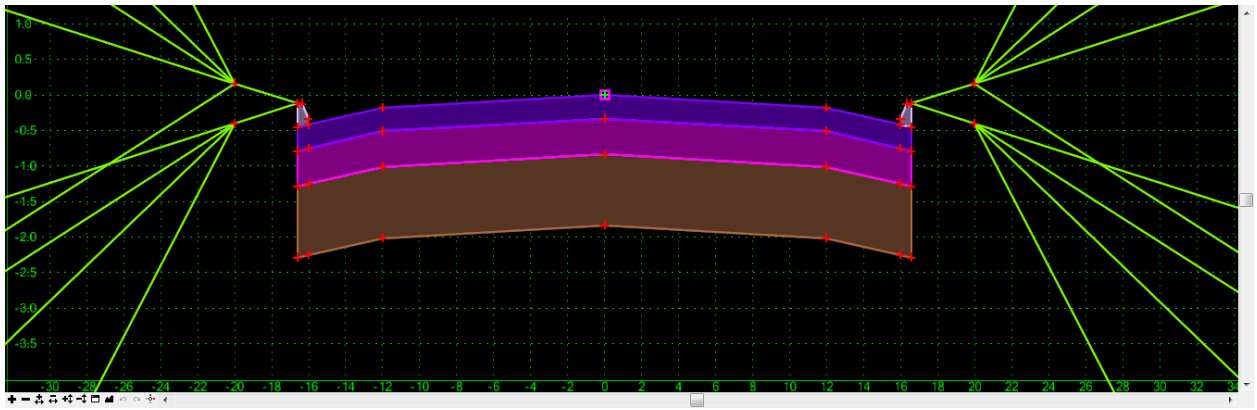


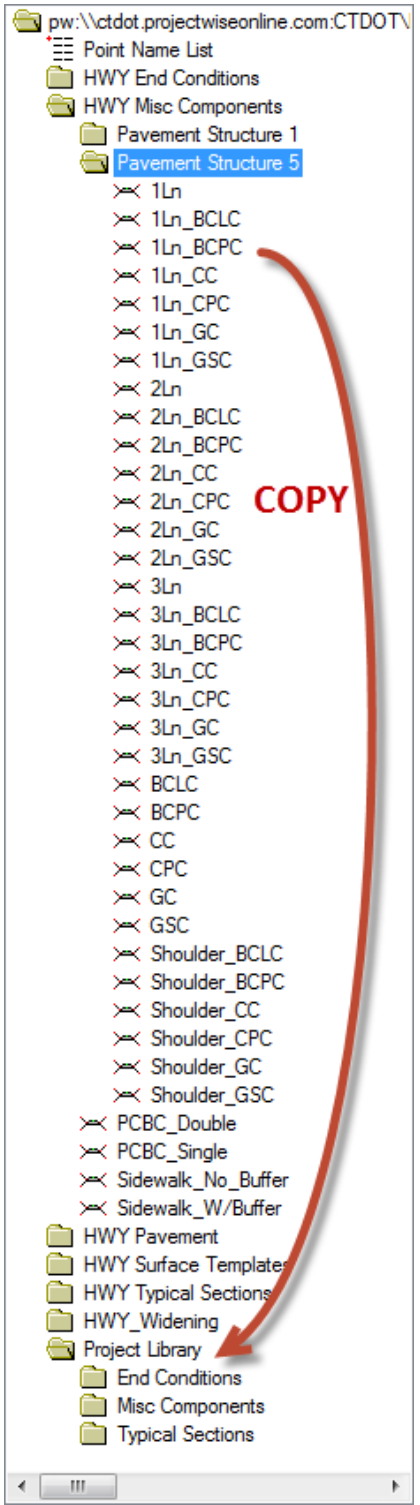
3. Use the Project Library Folders as your working area by copying the needed pre-designed templates down from the top folders. This way you always have a fresh copy to use as your build you specific project templates.

   If you are going to build your own templates or modify the one supplied you will need to have a vast understanding of which feature styles to use and what settings are specific to different point and component types. Browse to the template *HWY Typical Section > 2ln_PS5_BCPC.* Double click on the different points, closed shapes and end conditions.

   Take note of the following settings.
   - A. Feature Styles
   - B. Alternate Surfaces
   - C. Feature Name Overrides
   - D. Superelevation Flags (new for OpenRoads)

   This template is a two lane road with bituminous concrete curbing using the pavement structure #5. Pavement Structures are found Appendix B of [The State of Connecticut MTG Pavement Design Catalog](#).



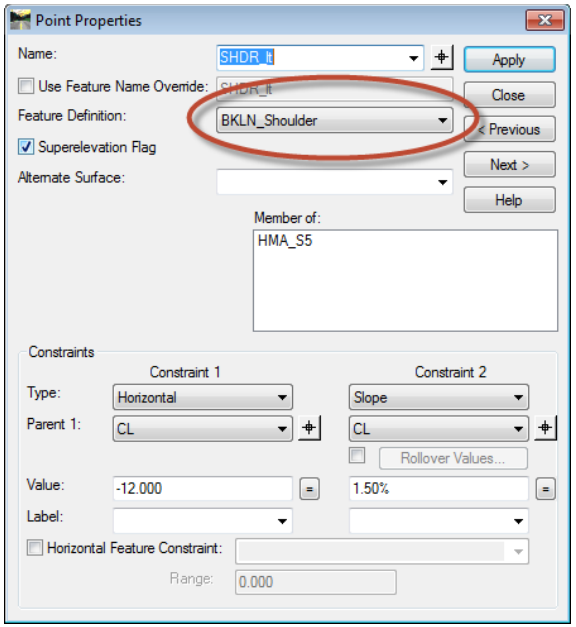


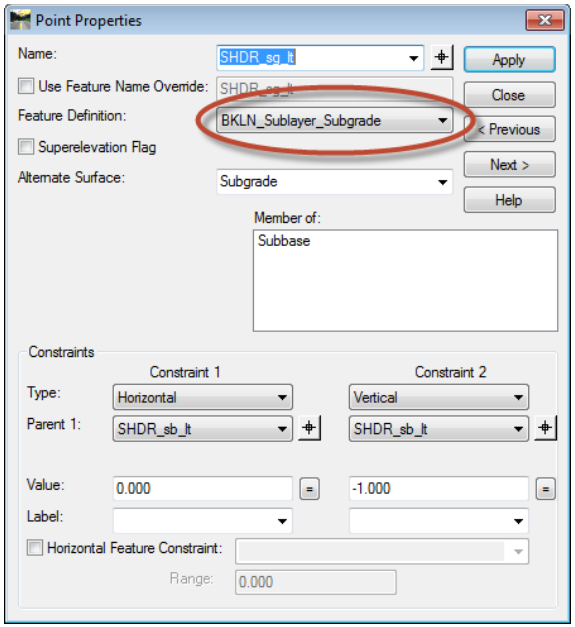
A. FEATURE STYLES

Point Feature Suffix….

On the top surface **BKLN_**

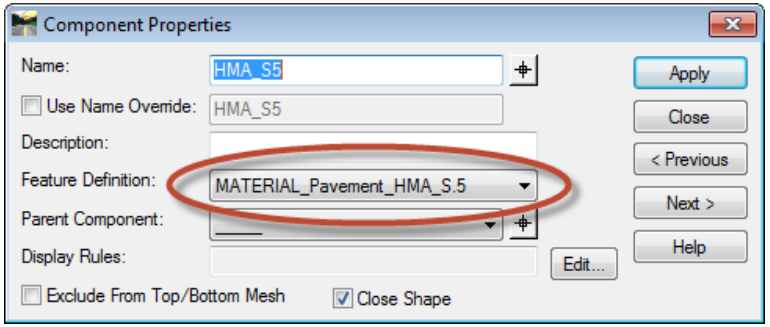
Below the top surface **BKLN_Sublayer**





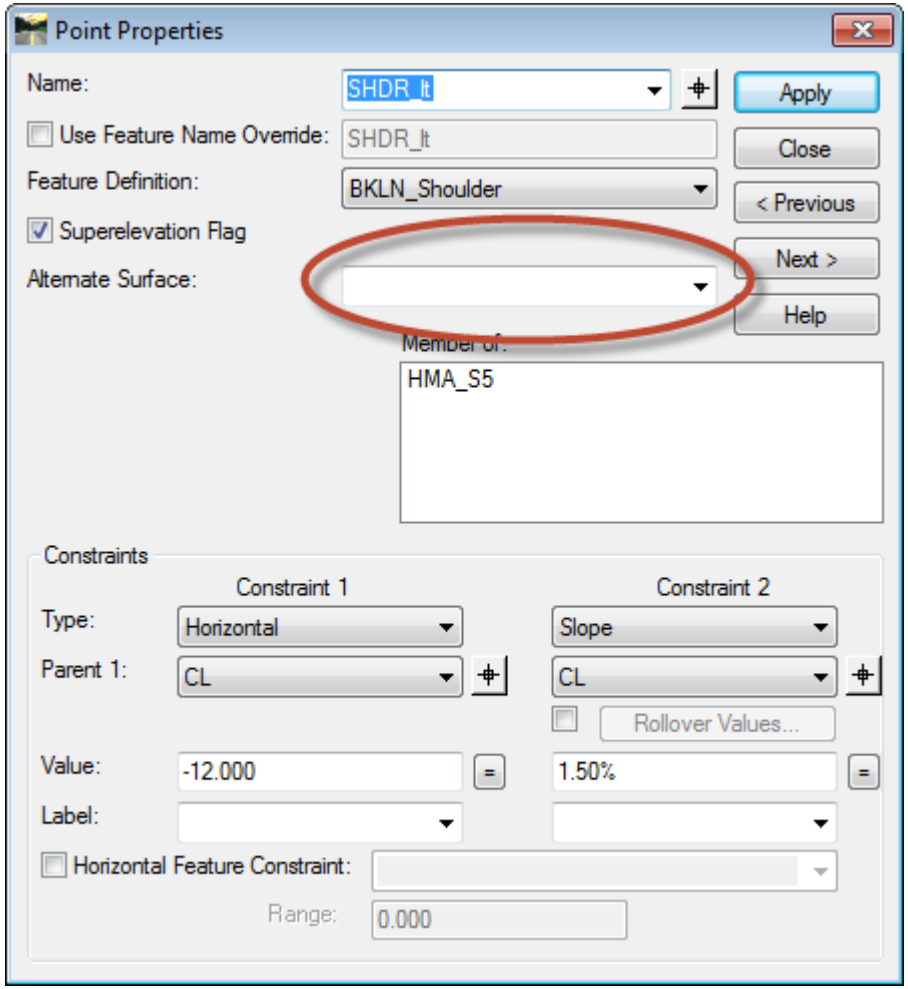
Components Suffix…

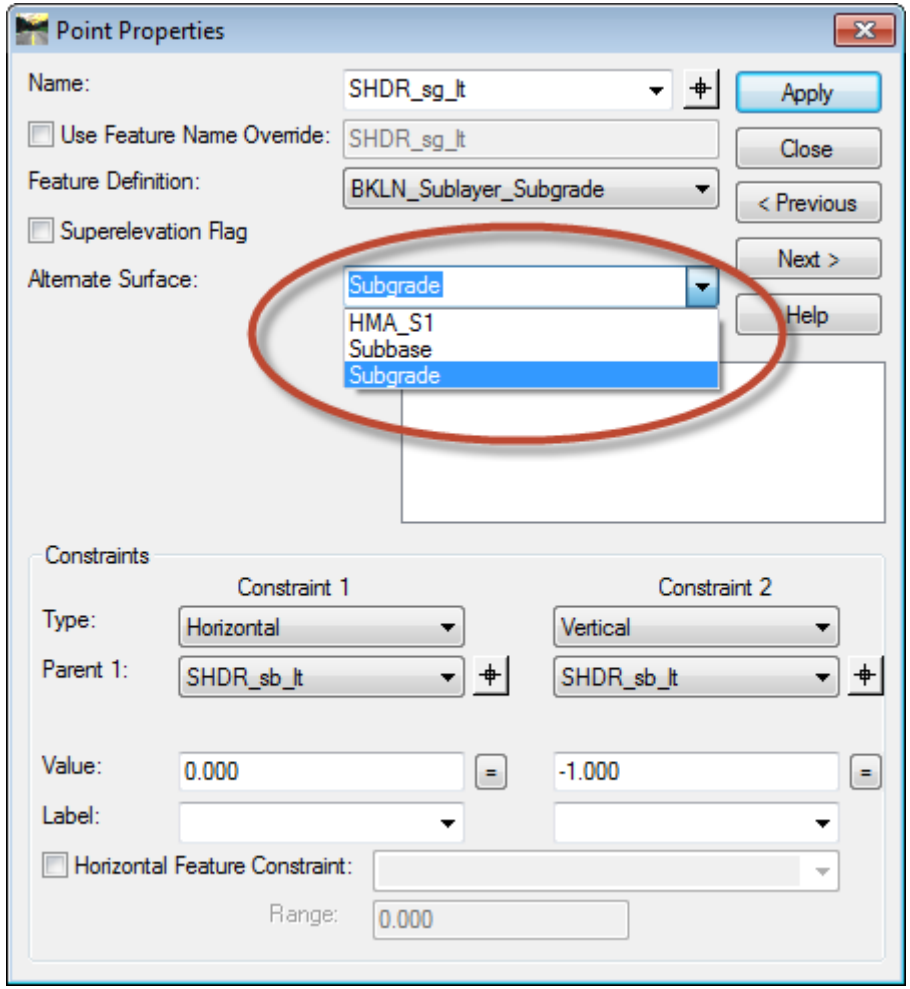
Material_



B. ALTERNATE SURFACES

Top points do not have an Alternate Surface but Subsurfaces will need a name.

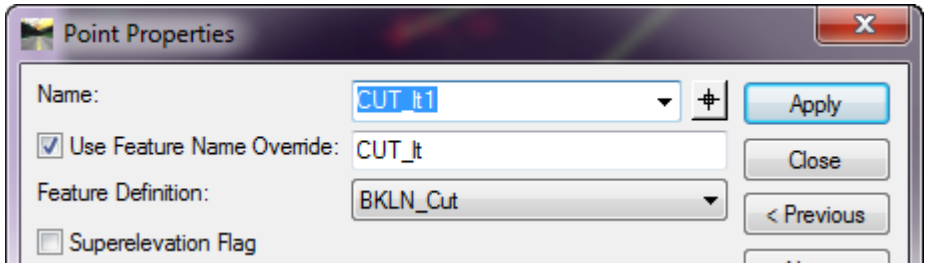


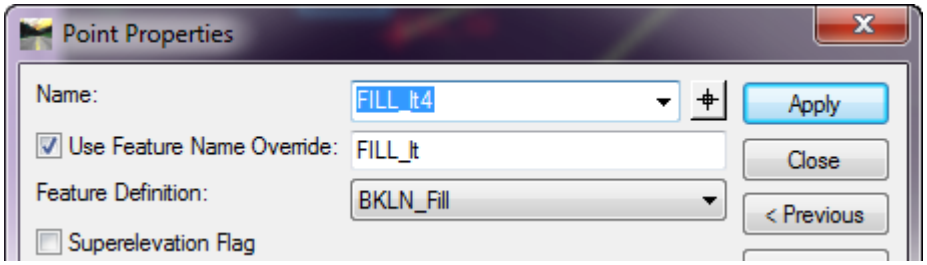


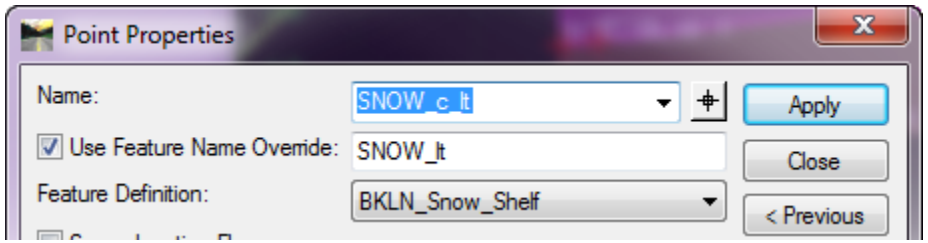
C. FEATURE NAME OVERRIDES

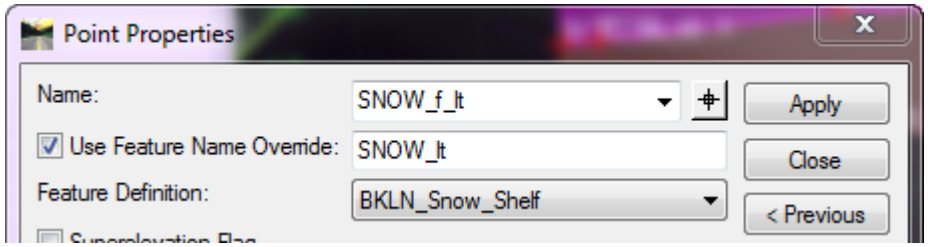
Points on end conditions

Make sure to Use Feature Name Overrides on Cuts, Fills and the Snow shelfs.



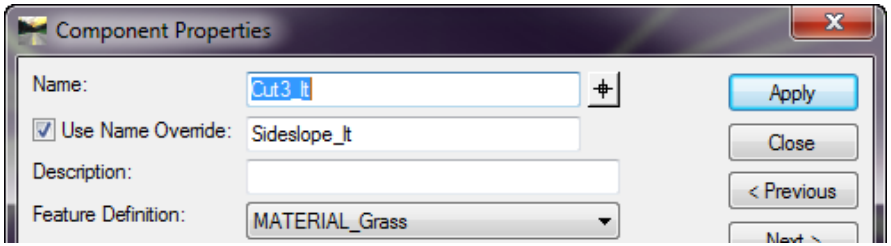


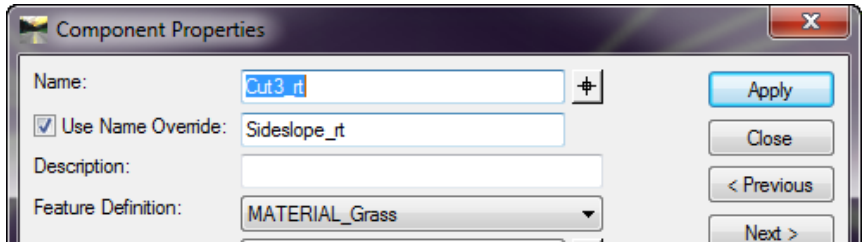




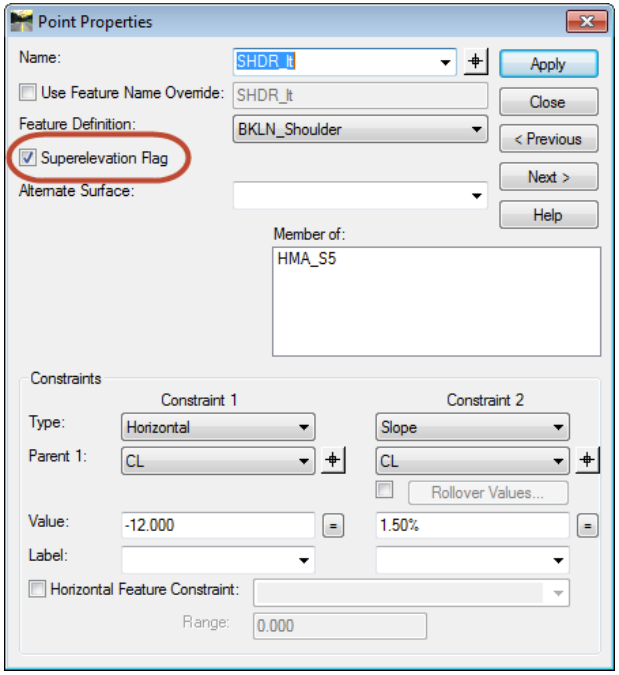
End conditions components

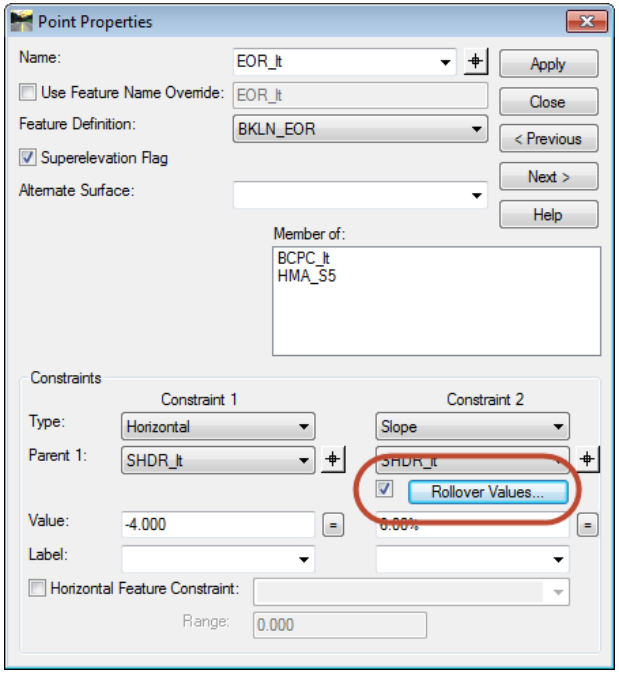
In the end condition components, the "Use Name Override" needs to be set for like slopes. For example, you have 4 possible ditch backslopes where only one at a time can solve. Setting the feature name override in the component properties assures the model stitching using the same component name. This is similar to what you have done correctly in the point properties for the point feature override.

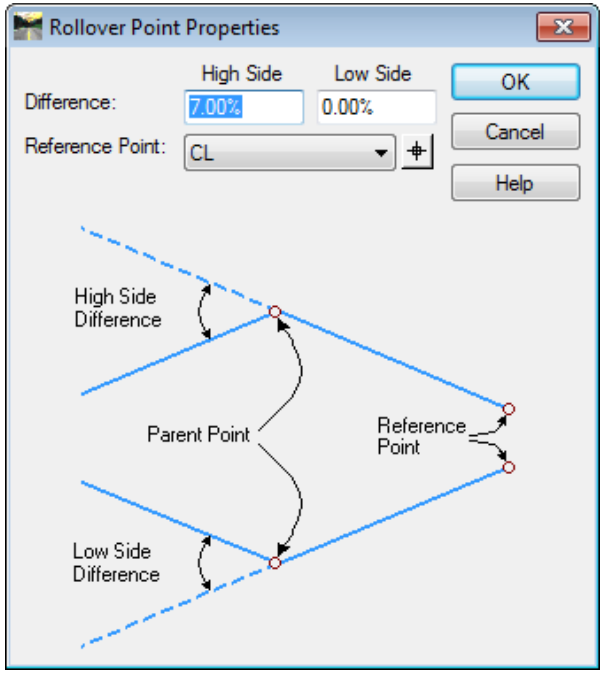




D. Superelevation Flags







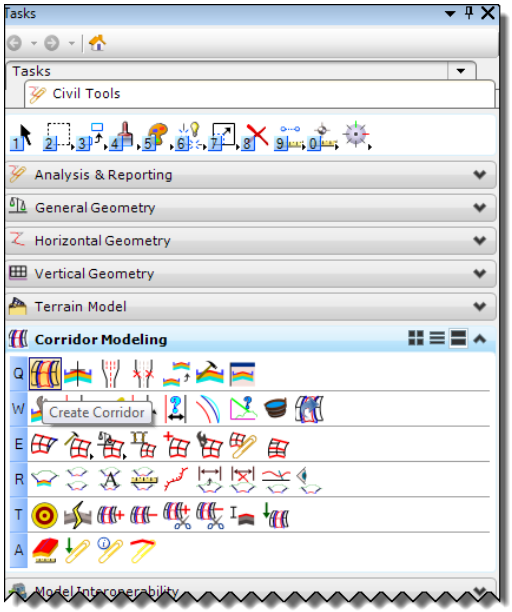
Chapter 5 Corridor Modeling

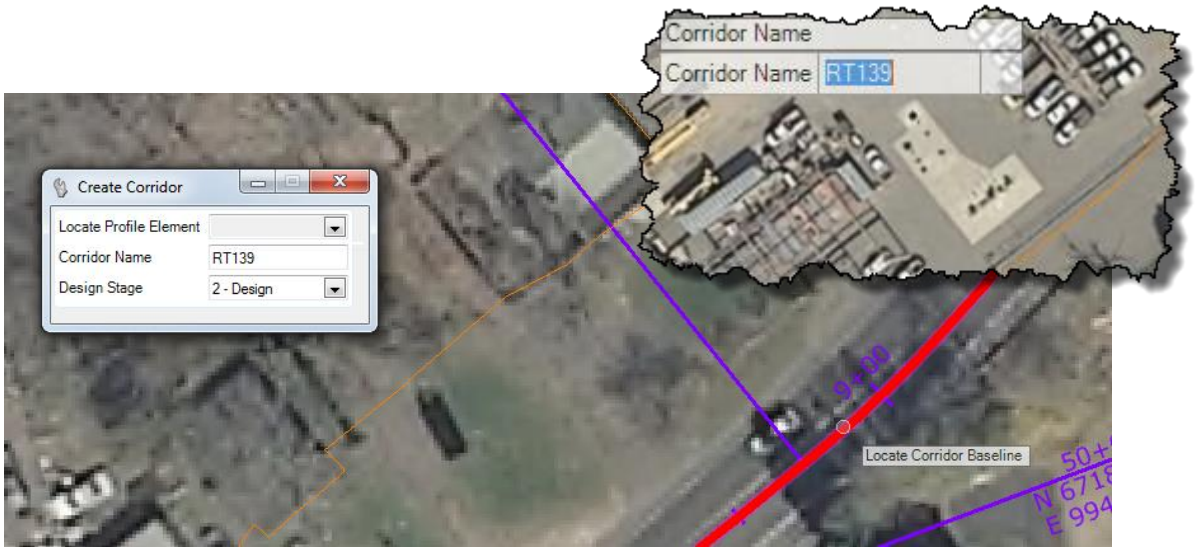
Model the Roadway Corridor

Section 5.1 Create a Corridor

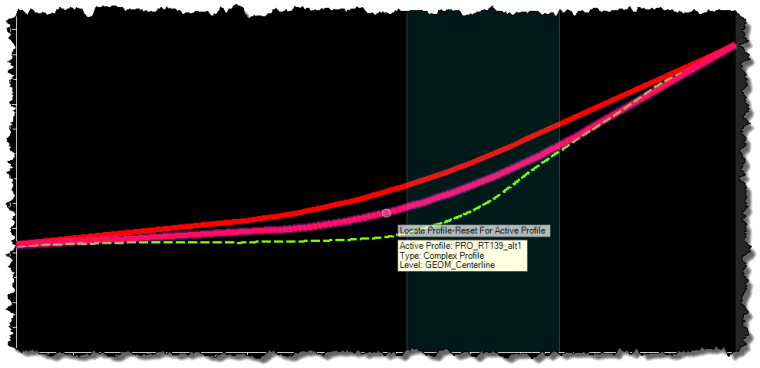
Corridors and models are no longer created in the Roadway Designer; they are created directly in the MicroStation Screen.

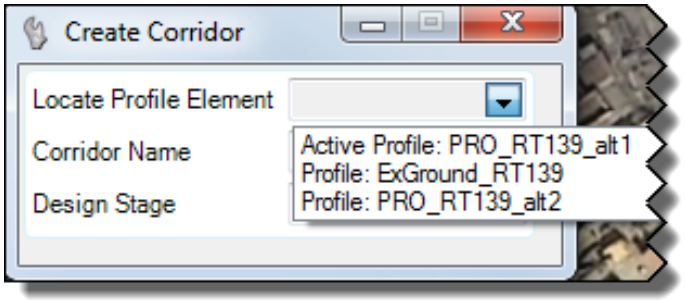
1. Go to *Tasks> Civil Tools> Corridor Modeling* and select the Create Corridor Command.
2. The Create Corridor dialog box will appear as well as a prompt to *Locate Corridor Baseline*. Enter in a name in the Corridor Name field and select the plan element for the corridor.



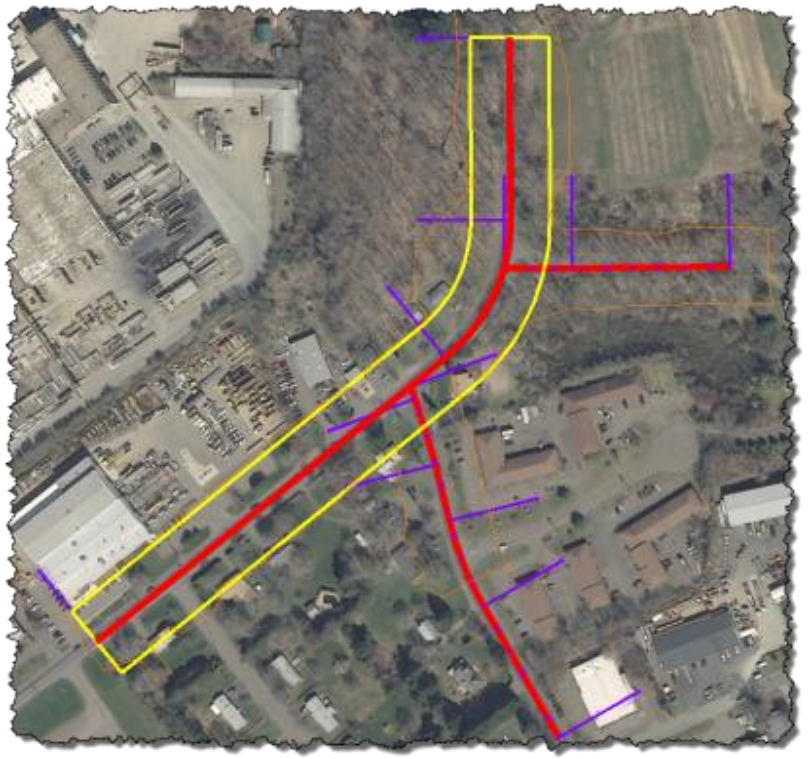


3. A prompt to *Locate Profile Element* will appear. Select the alignment in Profile view, select a profile from the dropdown menu in the dialog box, or right click to select the active profile. By selecting the Active Profile option the user can easily switch between profile alternatives and see how this affects the corridor model.

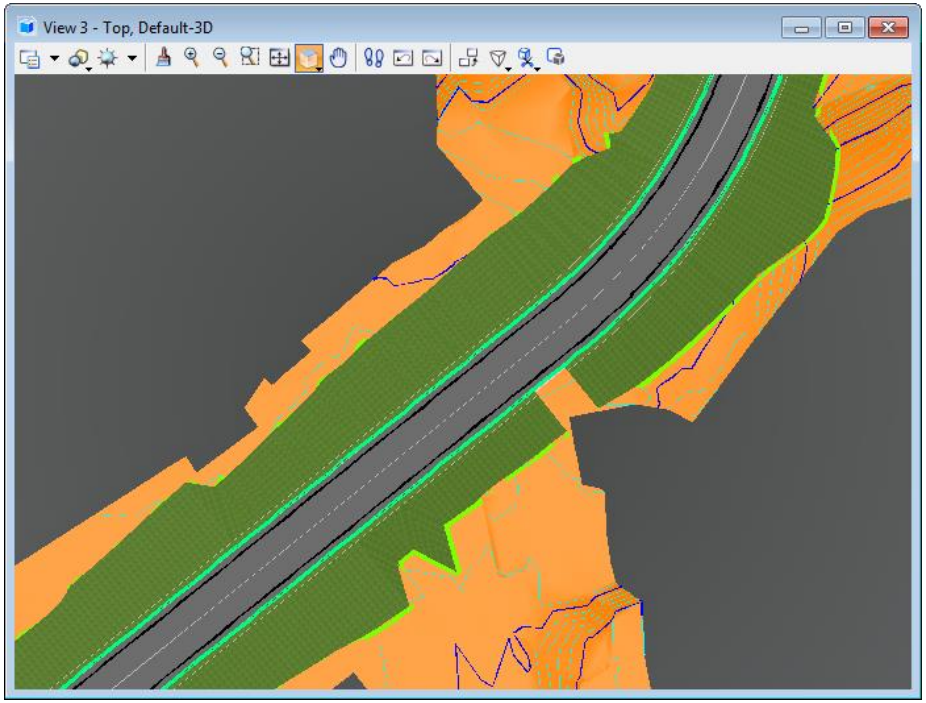




4. Enter a Corridor Name and left click to accept. A corridor feature should now be displayed around the alignment (the shape may be a different color depending on which design stage was selected when creating the corridor.



4. The *Select a Template* prompt will appear, click the ellipses button or Alt+Down to browse the templates. Select a template and Click OK
5. Left click to accept and apply the template, follow the prompts for Start Station, End Station, Drop Interval, Minimum Transition, Maximum Transition, Description. The components of the model should be displayed in plan view was well as the 3D model if it is open.



Section 5.2 Superelevation

Superelevation is calculated and created differently in OpenRoads than InRoads, it uses SRL and SEP files instead of SUP files. Much of the application is done graphically using the heads up menus rather than the templates.

At this point the user should already have the following items:

- Terrain file (existing ground surface)
- Centerline geometry (horizontal alignment)
- Profile geometry
- Corridor
- Template drop(s)

Quick Step Preview:

STEP 1. Create Superelevation Sections

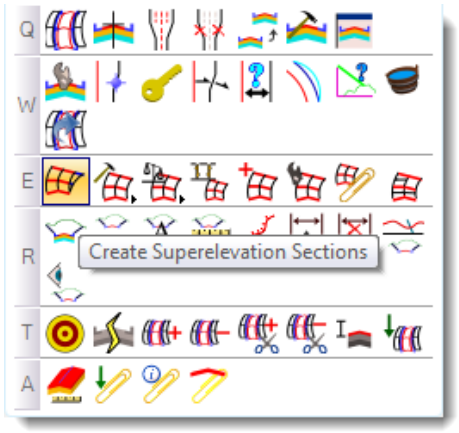
STEP 2. Create superelevation Lanes

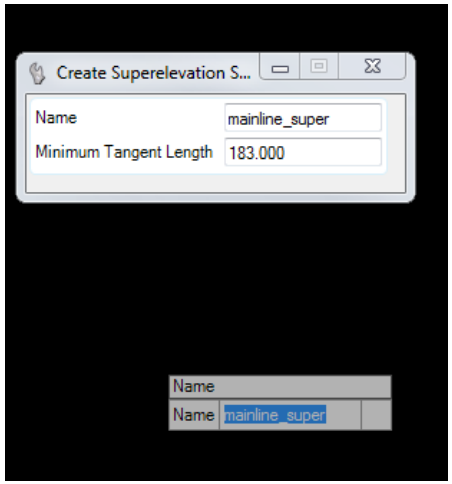
STEP 3. Calculate Superelevation

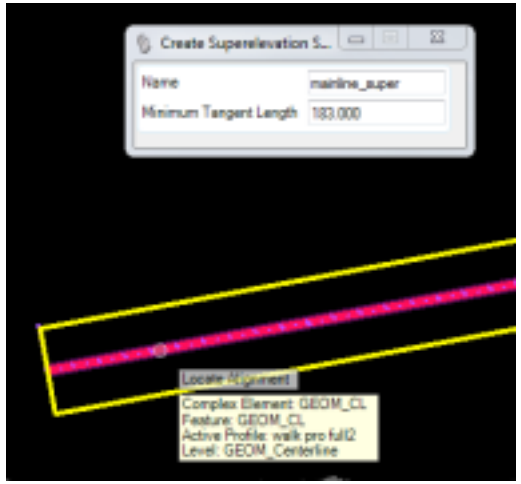
STEP 4. Assign Superelevation to Corridor

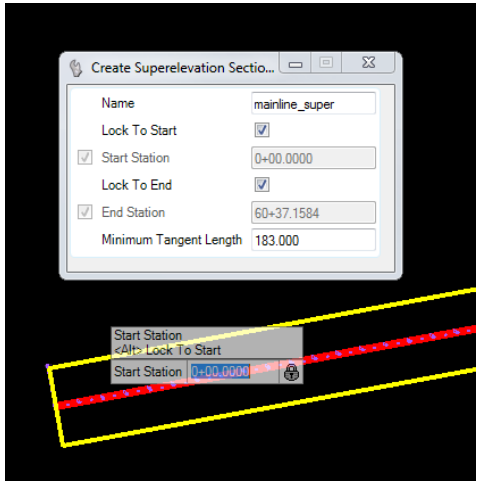
5.2.1 Step 1 - Create Superelevation Sections

1. The Superelevation tools are located under *Tasks>Civil Tools> Corridor Modeling*. Select Create Superelevation Sections and follow the prompts, give the element a *name*
2. Specify *a minimum tangent length*. The minimum tangent length depends on the design speed of the road. Minimum tangent lengths are covered in the highway design manual.
3. Data point the *centerline alignment* and left click to accept.
4. Another dialogue box should appear, select the start and end stations and click through to accept.



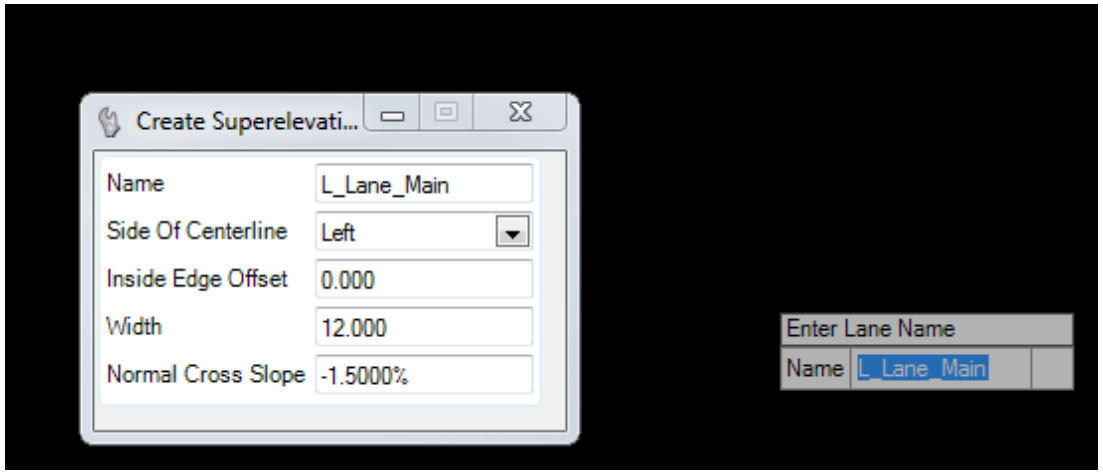






5.2.2 Step 2 - Create superelevation Lanes

The next superelevation task will automatically start, create superelevation lanes. This step needs to be done twice, once for the left lane and once for the right lane. For roads with more than two lanes additional super lanes will be required. In this example a two lane road is used.

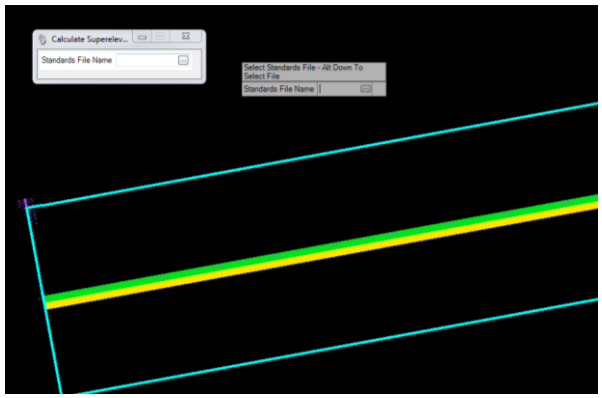


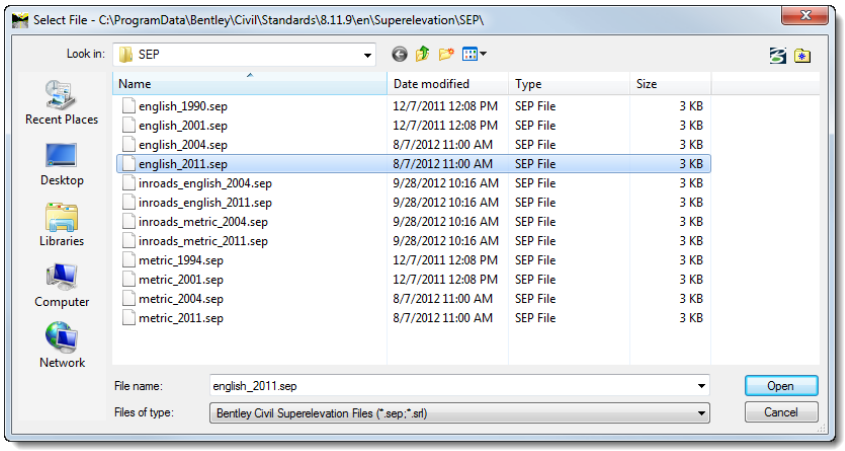
1. Give a meaningful name to the lane
2. Select which side of the centerline the lane is on
3. Determine the inside edge offset (in the case of a two lane road each lane would have an offset of 0. For a multilane road the inside edge offset would be the width from the edge of the lane to the centerline.
4. In this example the normal cross slope is 1.5% because it is a two lane road, for a 4 lane road the outermost lanes would have a normal cross slope of 2%. See the HDM for more information on lane cross slopes.
5. Repeat process for each lane (in this example the ***create super elevation lane*** command was done twice, once for the left, once for the right)

5.2.3 Step 3 - Calculate Superelevation

Once the lanes are created, right click to reset and move on to the next tool. The calculate superelevation dialogue should appear automatically.

1. Browse to the superelevation resource files and select File of Type. The SEP or SRL format can be used, each has multiple AASHTO years, select the most recent year.





2. The next dialogue box to appear will depend on which file type was selected for calculation. For the SEP file method, the dialogue box will ask for the following fields. Data point through the fields to accept the entries.

    a. E selection, CTDOT uses an e max of 6% for rural roads and 4% urban roads.

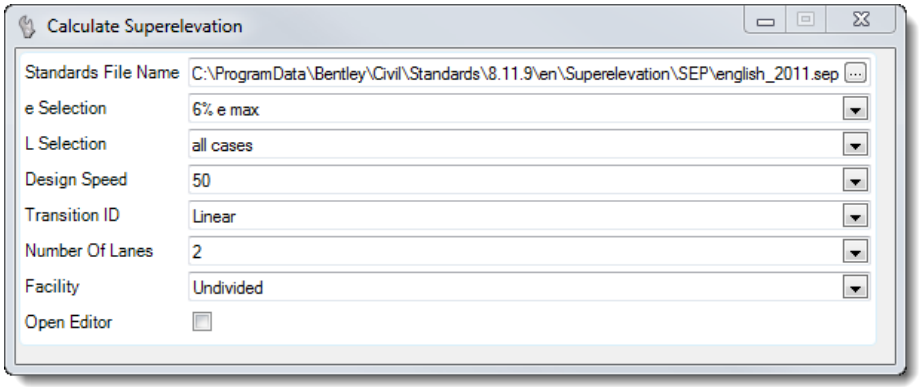
    b. L selection

    c. Design speed

    d. Transition ID

    e. Number of lanes

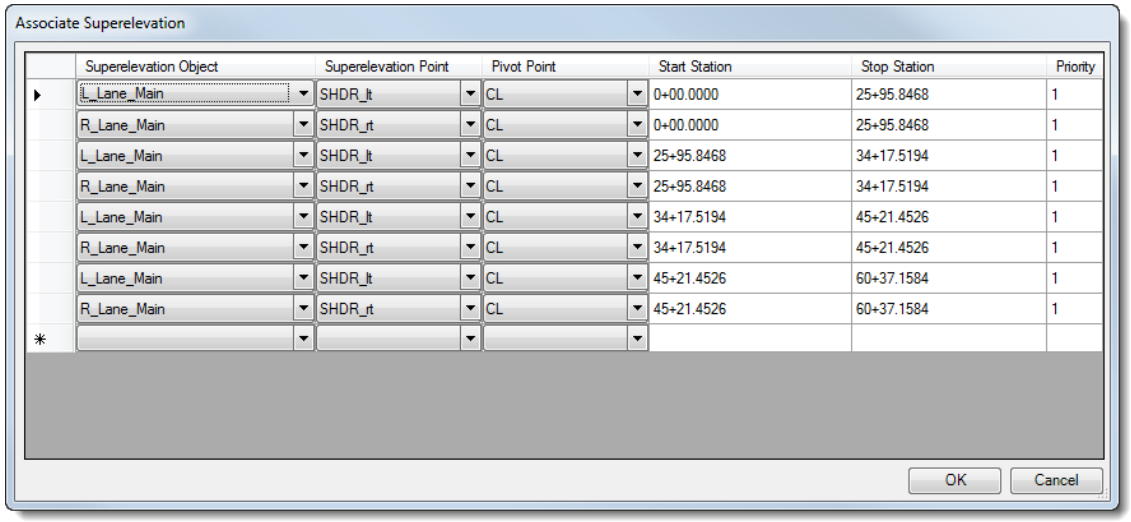
    f. facility



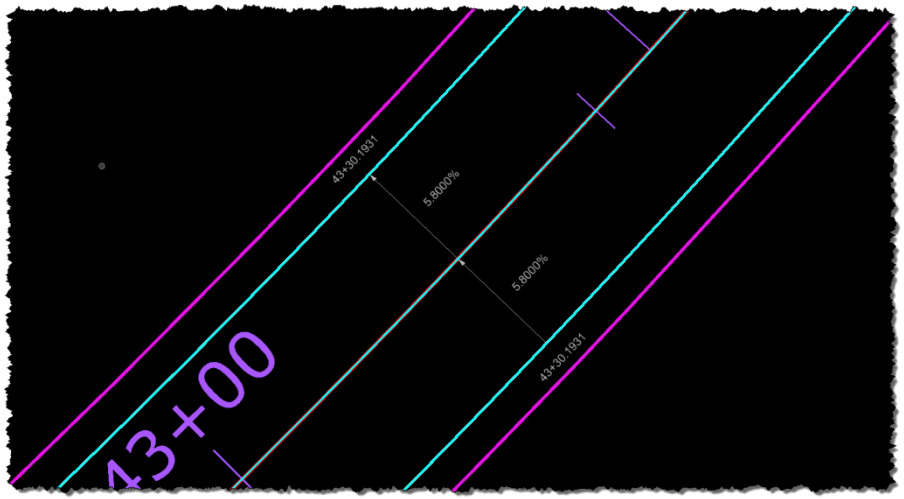
5.2.4 Step 4 - Assign Superelevation to Corridor

The next step is to assign the superelevationto the corridor.

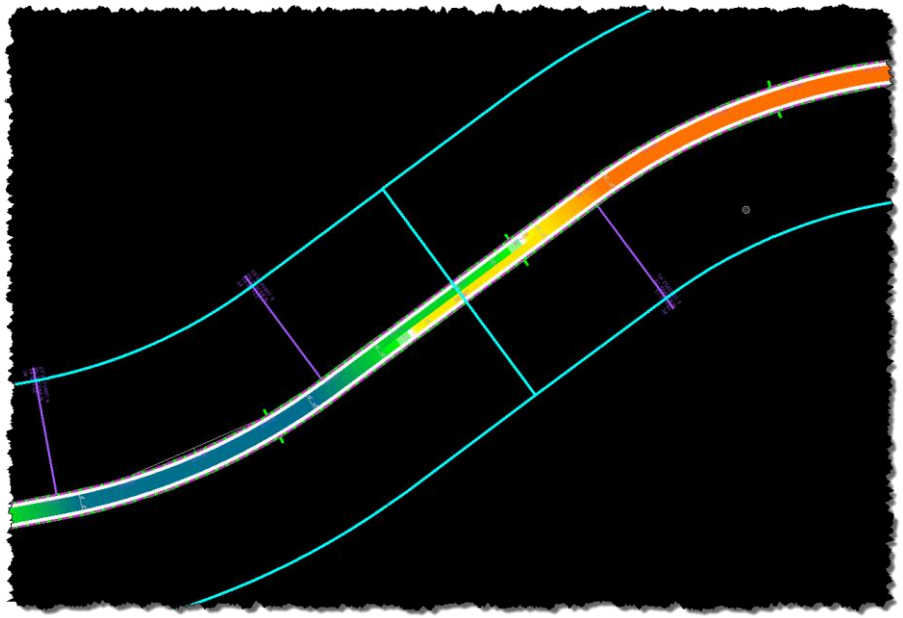
1. Click the Assign Superelevation to Corridor Command
2. When prompted, select the super sections.
3. When prompted, select the corridor.
4. The associate superelevation window should appear. Check over the points to make sure there are no errors and that the superelevation points and pivot points make sense, SHDR_lt with the left super lane and SHDR_rt with the right super lane.



5. Click OK, The Superelevation graphics should appear. The normal crown, reverse crown, and full super points should appear with labels as shown below.



To get a thematic visualization of the super grade changes toggle on the fill button in the view attributes window.

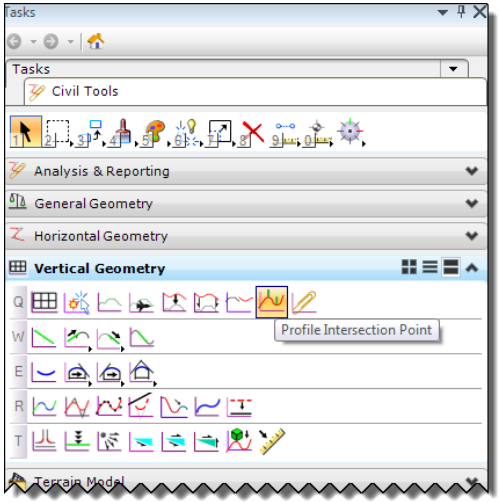


Section 5.3 Modeling Intersections.

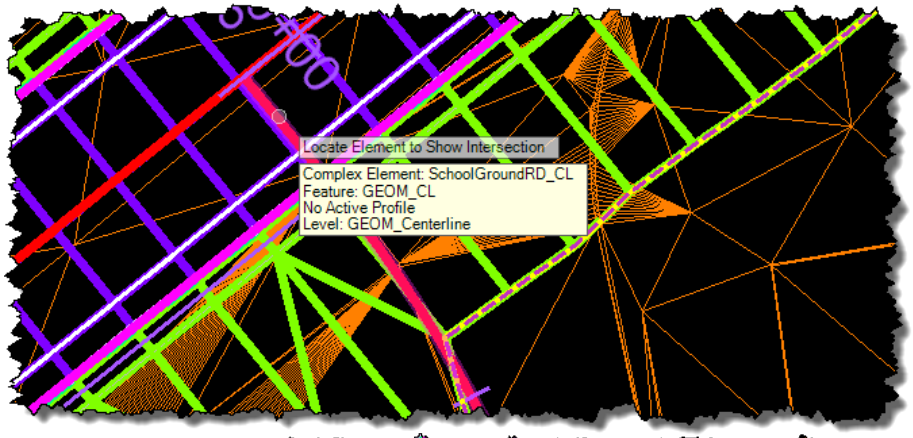
Side alignments are modeled a bit differently because the main line is constraining how the side road meets in. Alignments, models and corridors have to be adjusted to meet into the new proposed road. The alignment for a side road meets in at the alignment of the main line, because of this, the side alignment has to match the main line until it is off of the main line, or the two models have to be warped to accommodate each other.

5.3.1 Creating the Side Road Alignment

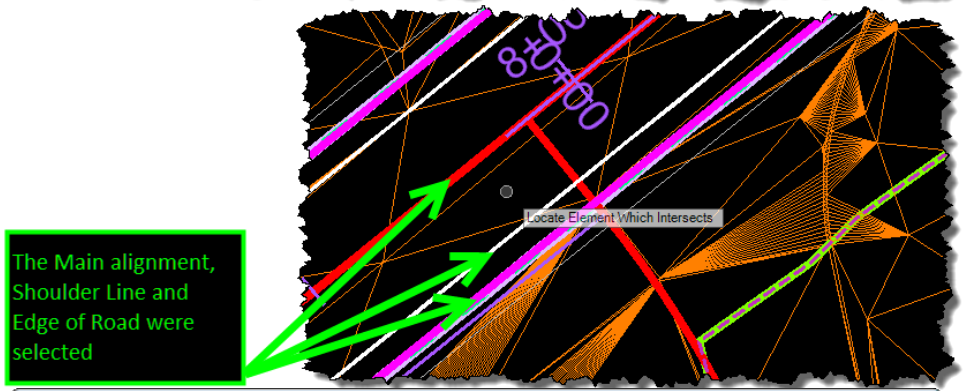
1. Follow the steps in section 3 to create the side road horizontal alignment and vertical profile window.
2. Display the points on the main line which cross the side road alignment. Go to *Tasks> Civil Tools> Vertical Geometry* and select the **Profile Intersection Point** command.



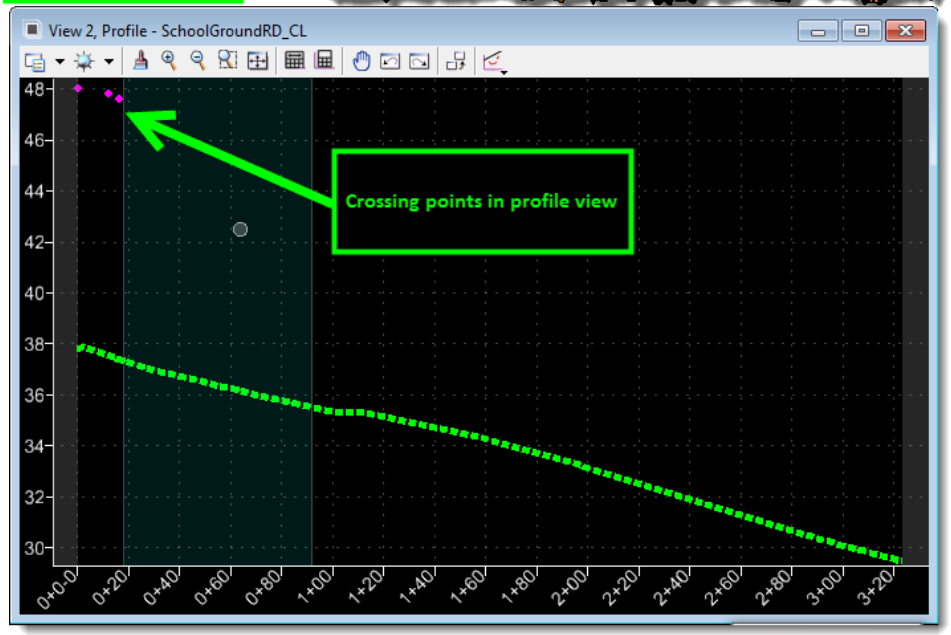
3. The prompt *Locate Element to Show Intersection* will appear. Select the side road alignment.



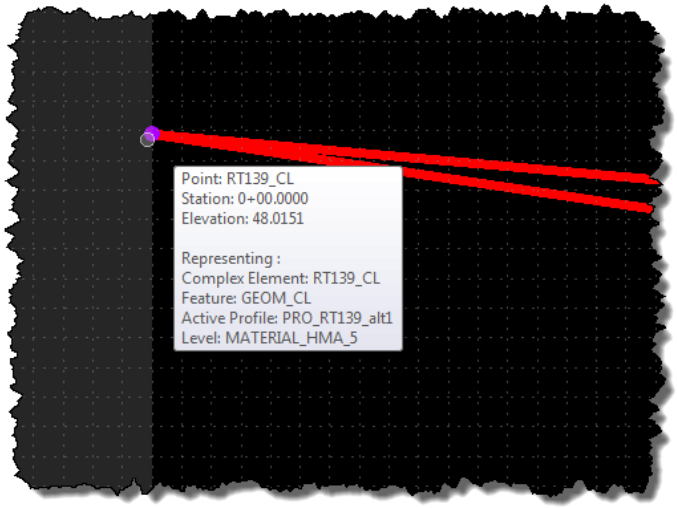
4. Another prompt will appear asking to *Locate Element Which Intersects*. This is asking which element crossing points the user wants to appear on the profile. In this example the Main Road alignment, shoulder line, and edge of road elements were selected. When finished selecting elements, right click to complete the selection.



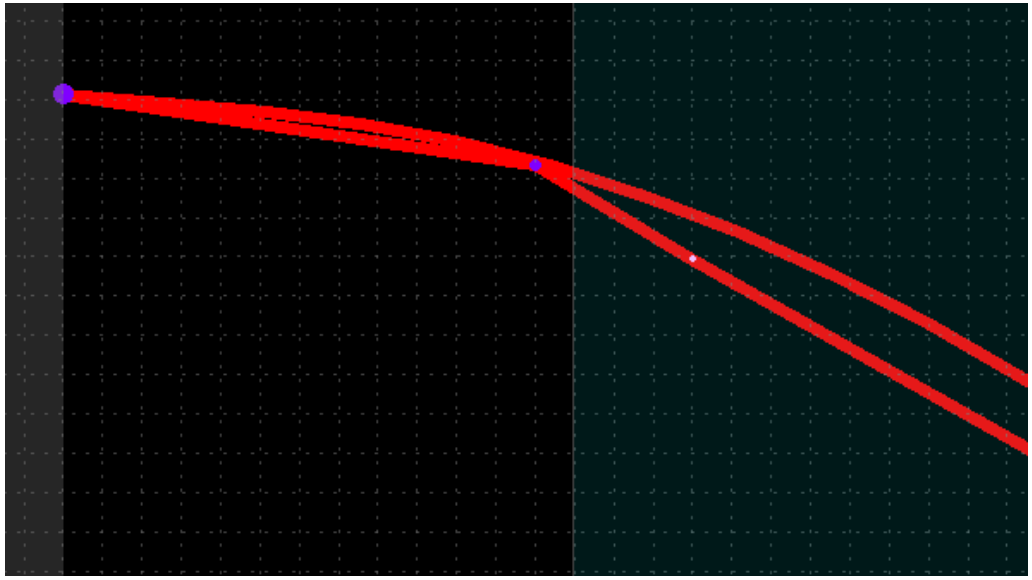
5. The crossing points should now be displayed in the profile view. Fit view may be needed to locate the points, and the colors/ line weight may need to be changed to make them more visible.



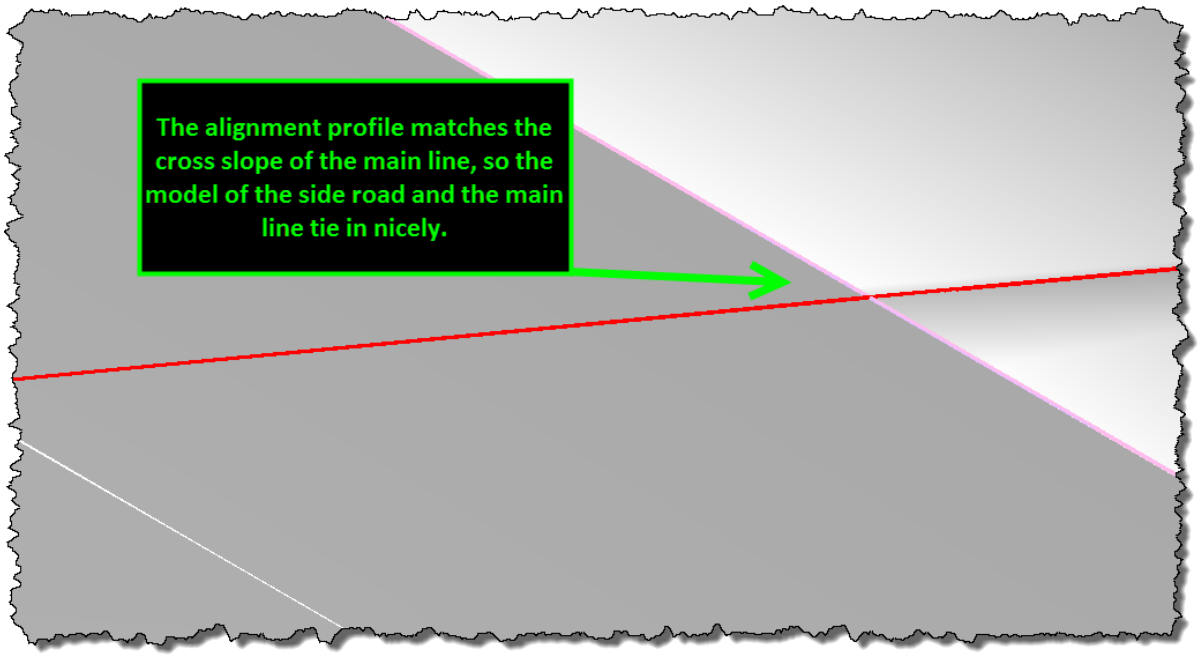
6. Hovering over a point in profile view will tell the designer what feature the point is representing as well as geometric information.

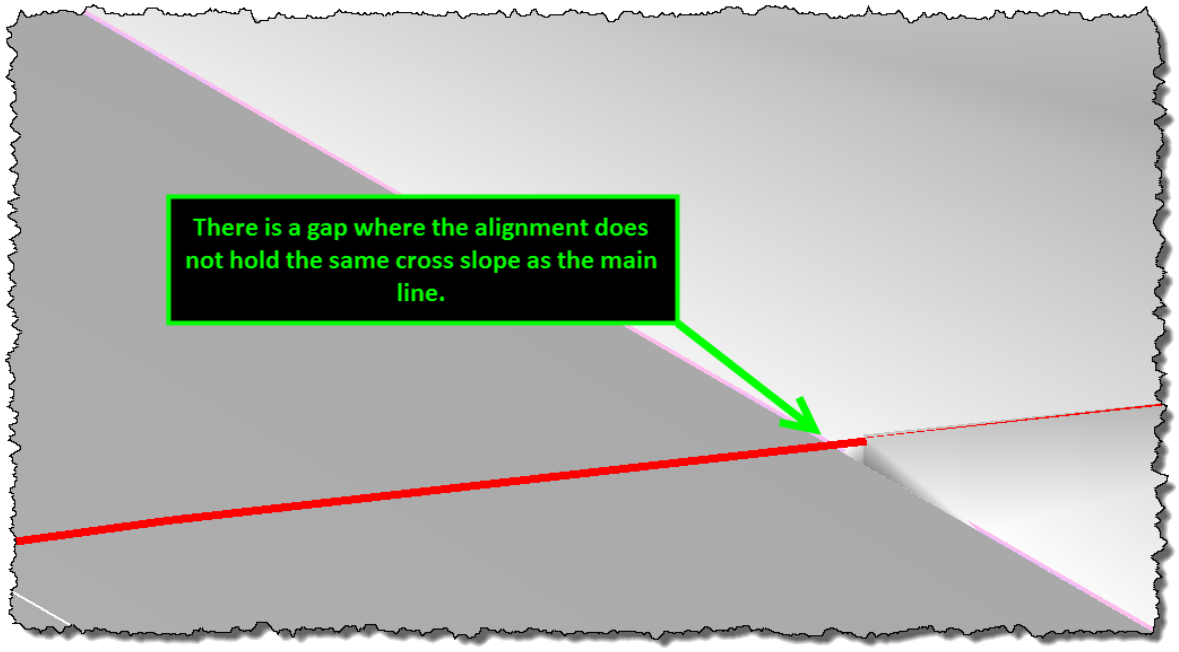


7. Create profile elements for the side road alignment. To maintain the side slope of the road, the side road alignment will need to match in to the main line. The points displayed earlier will help the designer achieve this. Select the *Profile Line Between Points* command and connect the crossing points. In the example shown the top vertical alignment is only connected to one crossing point. The lower alignment is connected to all three of the crossing points. The *Profile Complex By Elements* command can connect individual elements to create a single profile.
* Remember to use meaningful names when creating profiles.



8. The example below shows the difference between the models using the top profile and the bottom profile.





5.3.2 Creating the Side Road Corridor

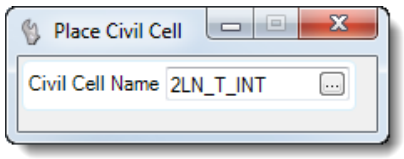
1. Create the Side Road Corridor. Now that the profile is complete, a corresponding corridor needs to be created. Repeat the steps in section 17. *Remember to name the corridor correctly to avoid confusion later.
2. Attach a template to the corridor. In the example below the model has corridors intersecting. The designer can edit the corridor as needed and create alignment elements for the corridors and adjust the template drops as needed, or they can use a civil cell (See section 4.5).

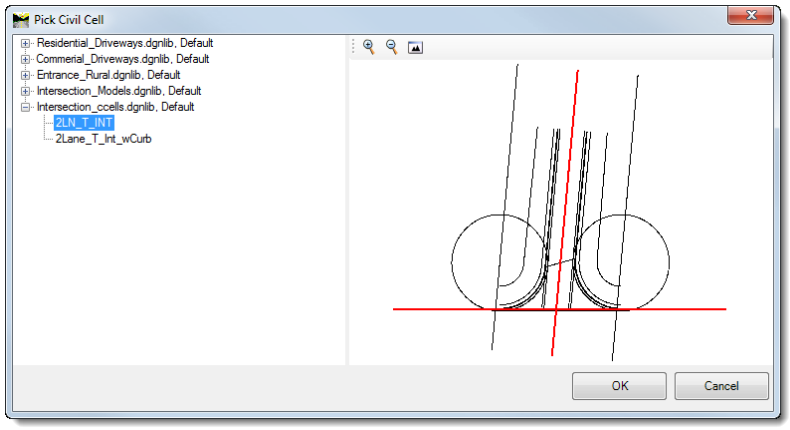
Section 5.4 Civil Cells

Model an Intersection with a Civil Cell

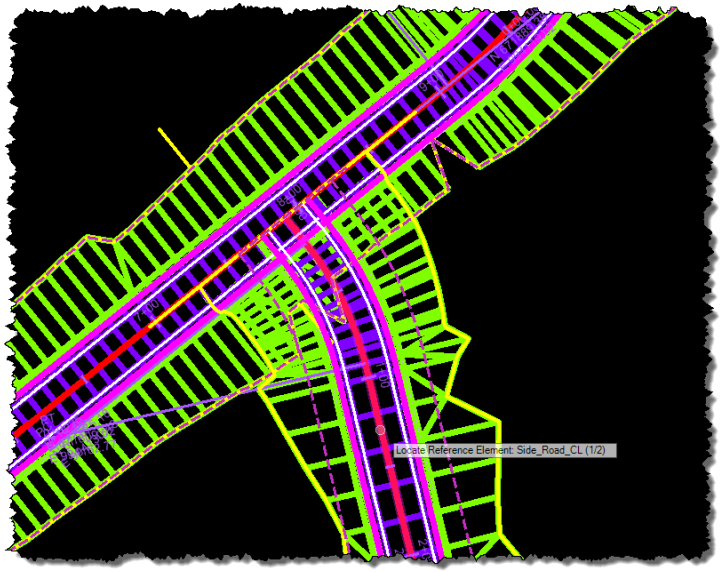
There are many different types of civil cells that help automate design tasks. Civil cells use reference elements for placement, meaning you can use the same civil cell in many locations and it will change based on the reference elements used to place it. Civil cells can be edited after placement as well has “dropped” to allow the designer to use pieces of a civil cell if necessary.

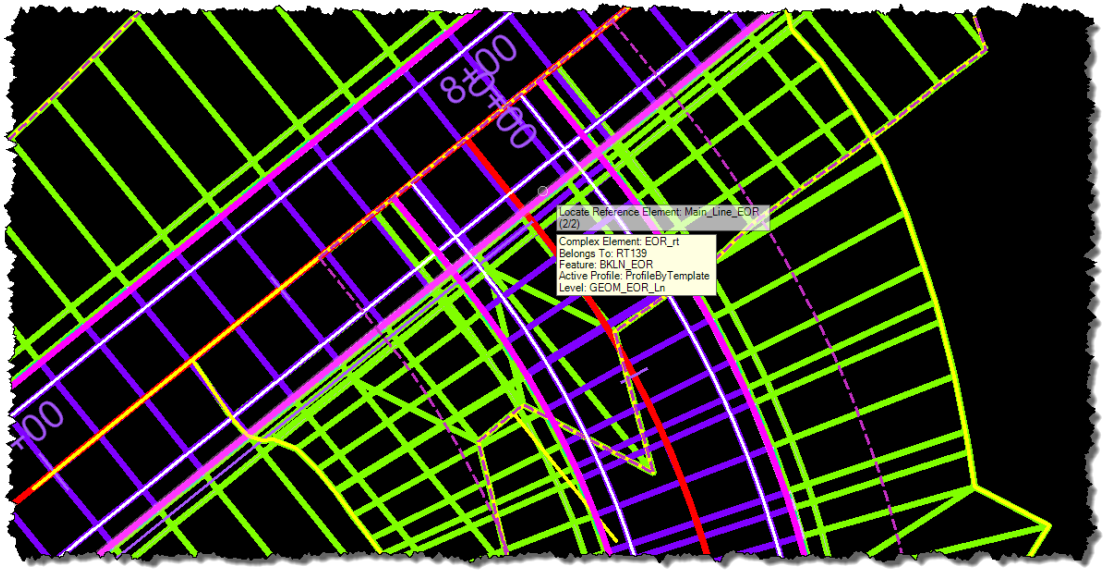
1. To place a civil cell go to *Tasks> Civil Tools> Civil Cells* and select the *Place Civil Cell* command.
2. The Place Civil Cell dialog box will appear, click the ellipses button to *browse available civil cells*. When selecting a civil cell preview will be shown to the right of the selection. Click OK



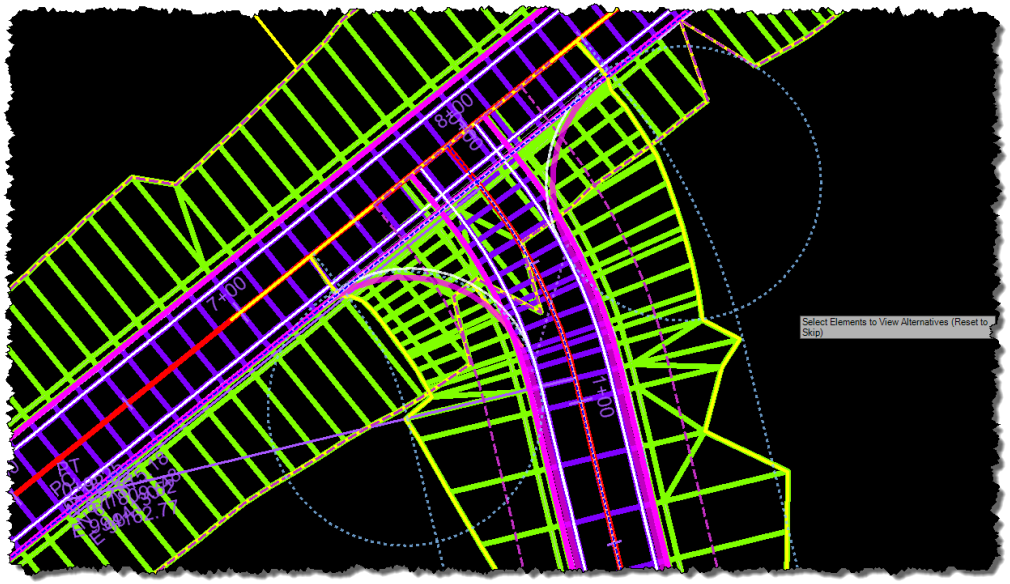


3. The prompts that appear with each civil cell vary based on what type of civil cell is being placed or what the creator of the civil cell labeled the references as. The reference prompts are usually intuitive, so be sure to read the prompt. In the example below the prompts indicate two reference elements are needed, one for the Side Road Center Line and one for the Main Line Edge of Road.

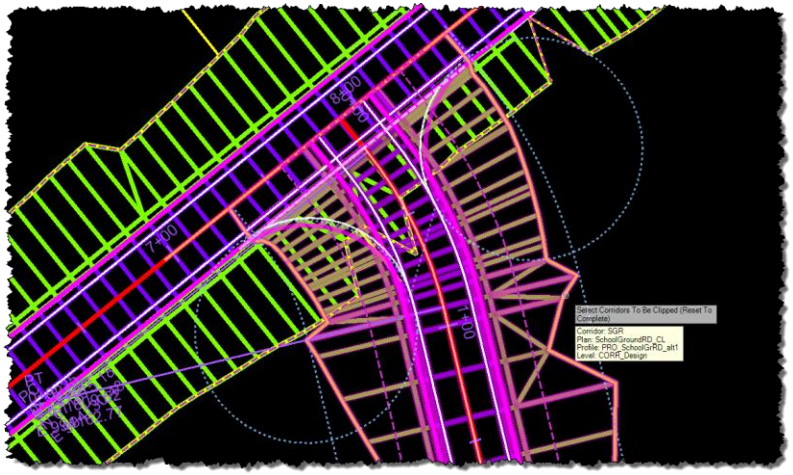


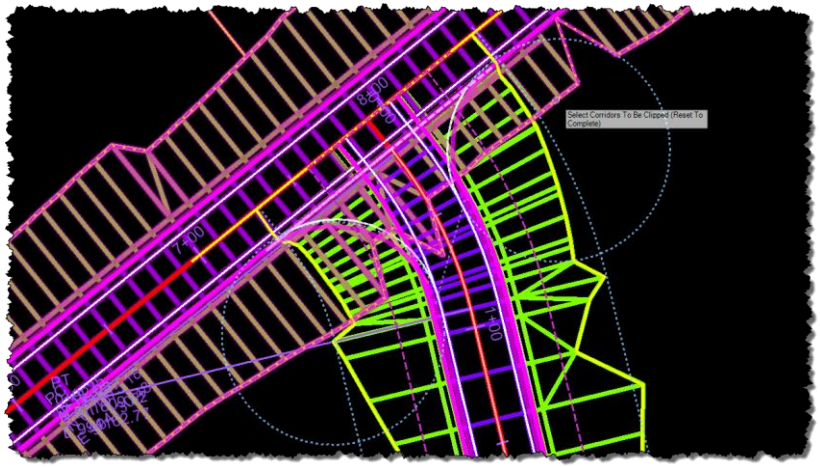


4. Elements of the civil cell should now appear on the screen, if there are alternative configurations you can view them at this point by selecting elements, or you can right click to move to the next step.

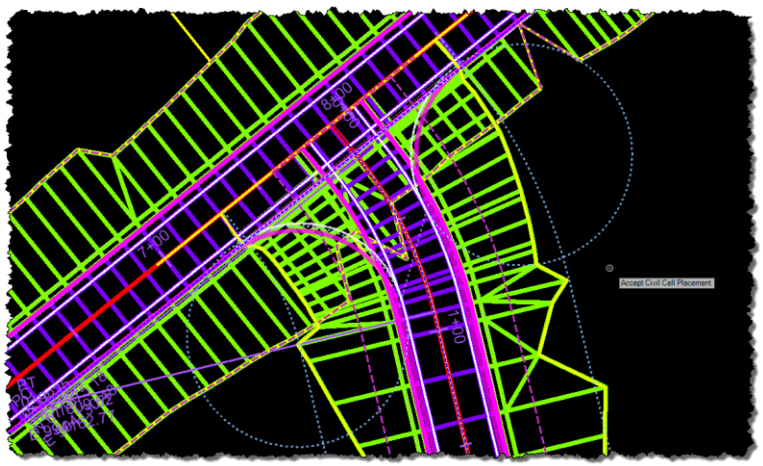


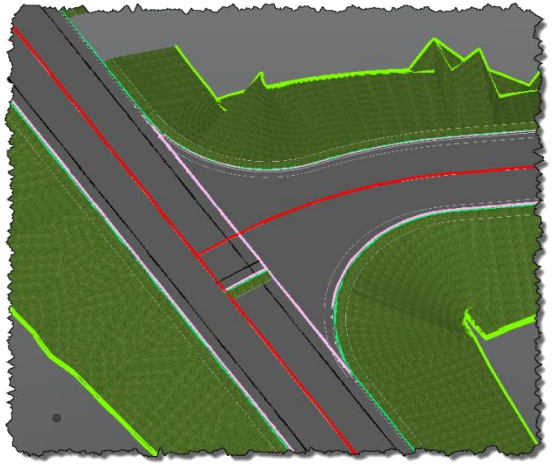
5. The next prompt will ask for the user to *Select Corridors To Be Clipped*. *note: this prompt will only appear if a clipping boundary was added to the civil cell when it was created. In this example the main line corridor and the side road corridors were selected. Right click to move on once the corridors (if any) have been selected.



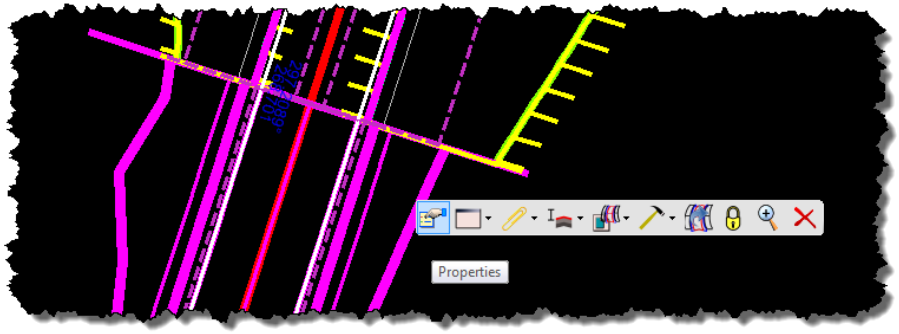


Left click to accept civil cell placement. The images below are the 2D Plan view in wireframe and the Isometric view 3D model. The corridor template graphics are visible on the main line. This will be edited in the next section.

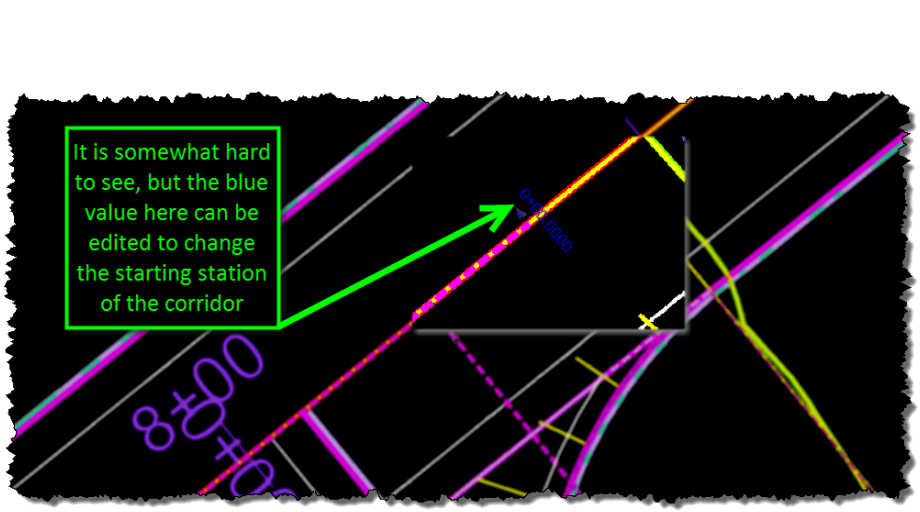


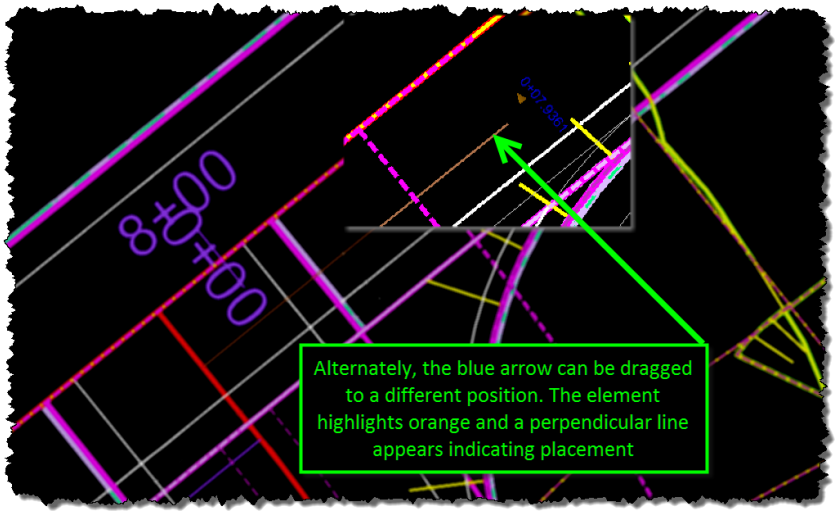


3. Adjusting corridors. Corridors have an outline around them identifying the limits of the corridor, this is similar to the outline in the Roadway designer from SS2.
4. Adjusting a corridor using properties. The heads up menu will appear if the corridor element is clicked and hovered over. From the menu, the designer can open the properties and change the start/ end range of the corridor. The limits should change graphically.

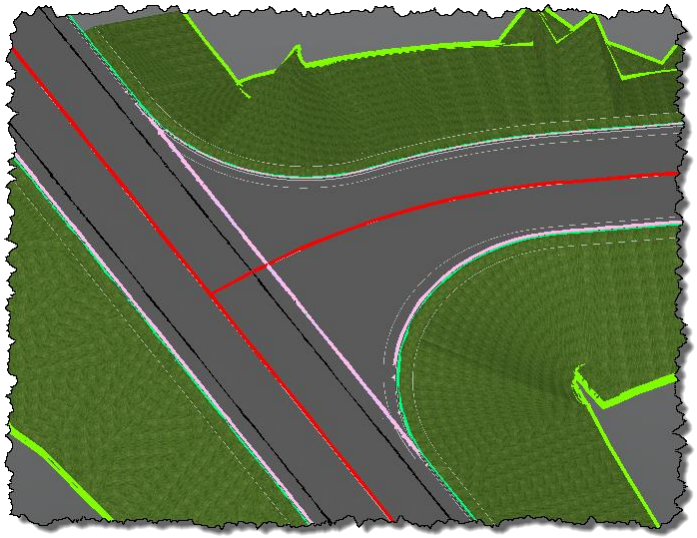


5. Adjusting a corridor using handles. The designer can also adjust a corridor using handles. The lines perpendicular to the corridor graphic are the handles. When selecting a corridor graphic small blue numbers will appear at key points. Clicking on them will give you the ability to edit the number and adjust the value. There are also small blue arrows at some locations. These can be dragged to adjust the corridor dynamically instead, as well as snapped to certain locations if the element is snappable.



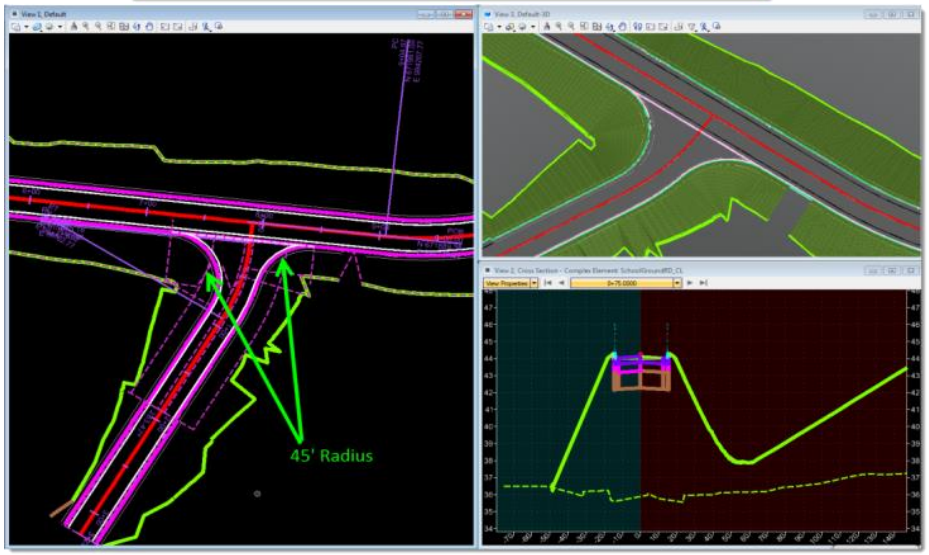


6. In the example below, the side road corridor has been adjusted to the back of the civil cell corridor graphic. The side road surface is no longer breaking through the main line.

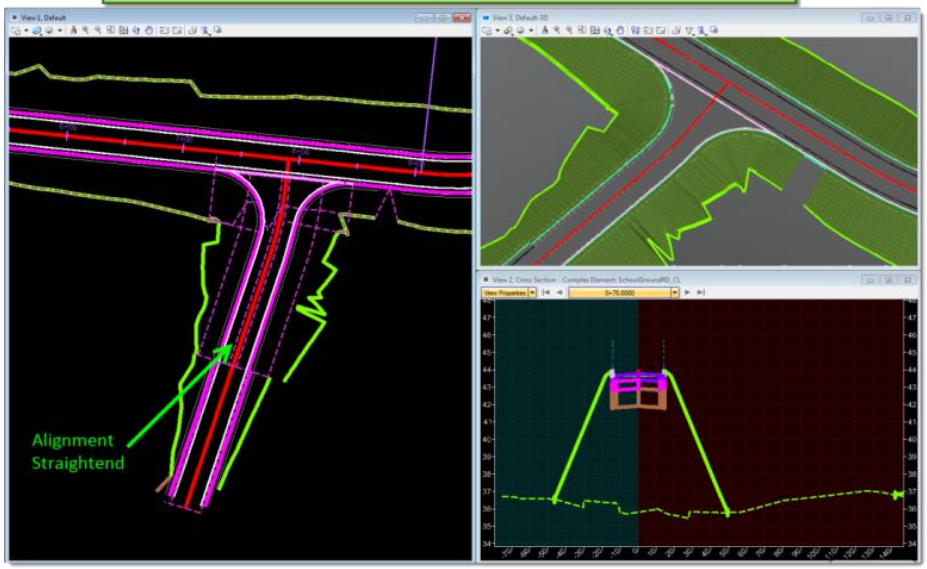


7. Editing geometric elements. Depending how an element is created, the designer can edit and adjust elements without disrupting and breaking apart the model. Many elements which selected will have blue handles appear as well as blue numbers. If there is a handle and number it means the element was created using design constraints. Many handles can be adjusted dynamically or the numbers can be entered manually. In some cases the changes may break an element but the undo command is useful when trying to edit elements.
8. In the example below there are three stages shown. The plan view, cross section view and 3D view are all visible. The first picture is the original model, the second had the alignment straightened and the third shows the radii of the intersection increased. Only elements in the 2D view were changed. The OpenRoads software automatically adjusts dependent 2D geometry, cross sections, profiles, and 3D models. This means less work for the designer as profiles, cross sections and 3D models do not need to be re-run each time a design change is made, all of these elements adjust automatically. *note: because of the changes the program needs to make to the model, when changing element values, allow the program to catch up and display the changes before moving on to the next edit.

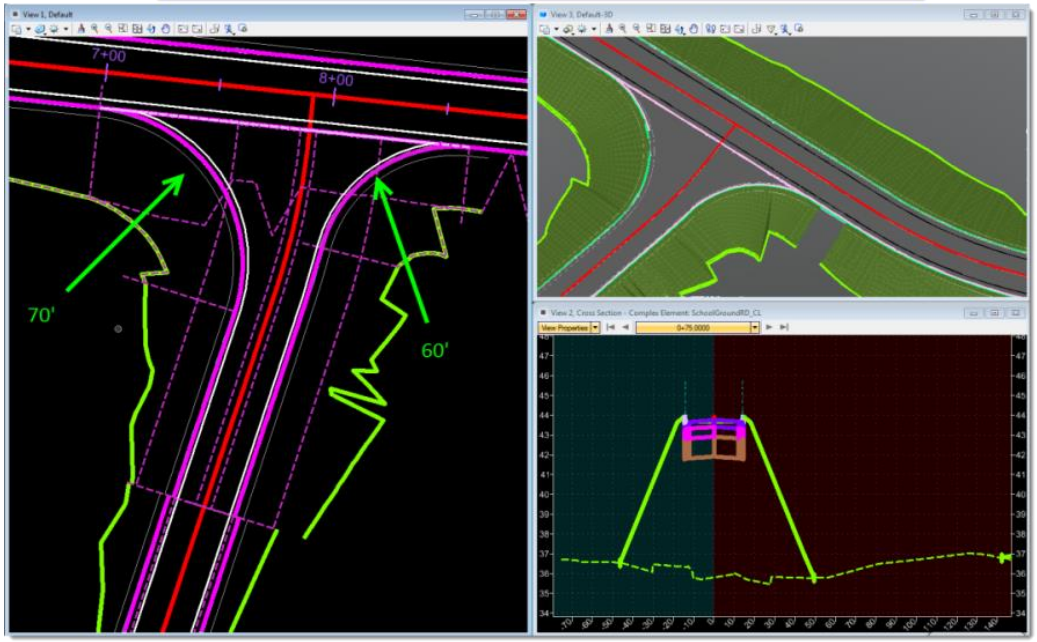
Original Model



Alignment Straightend



Curb Returns Changed from 45' to 60' and 70'



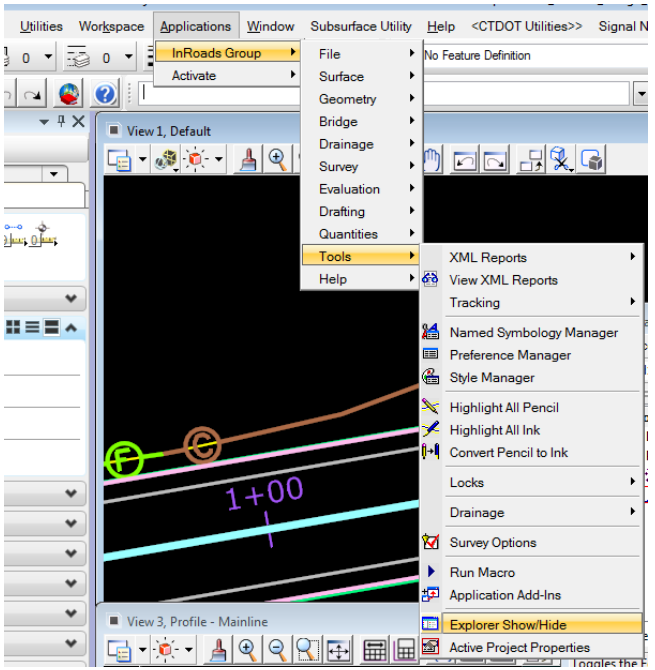
Section 5.5 Enhancing the Model

Review and Enhance the Complete Model

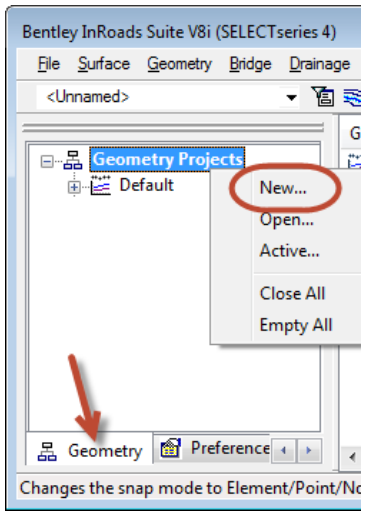
Chapter 6 Plans Production

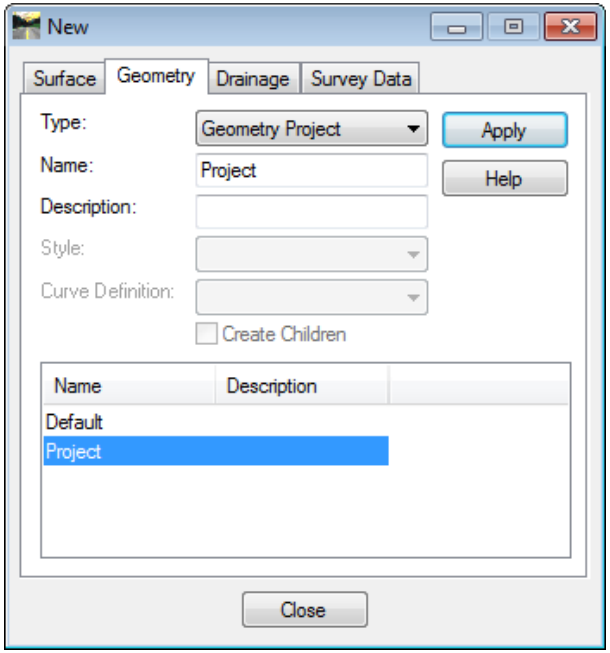
Sheet production for OpenRoads has not been completed, this software development will not be finalized until the next Major Release in the CONNECT version. You will need to convert your geometry back to an ALG file type to be able to use the Plan and Profile Generator.

1. Locate the InRoads Group Explorer window. If it is not visible go to the MicroStation pull down menu and select *Applications > Tools > Explorer Show/Hide*.

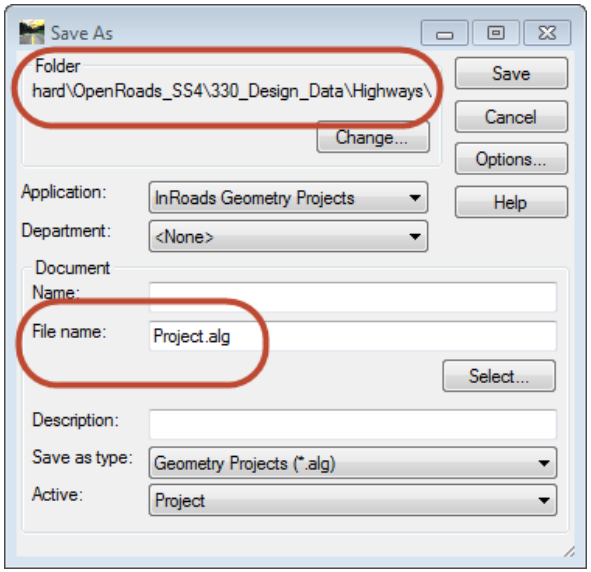


2. In InRoads Explorer select the *Geometry* tab, right click on *Geometry Project* and Select New. Type in a name in the *Name* field and click Apply.

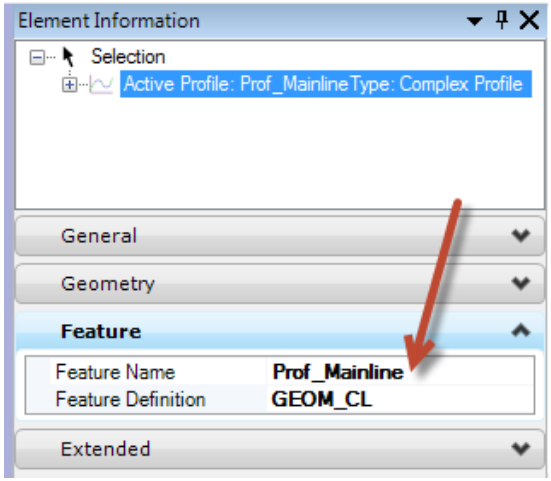




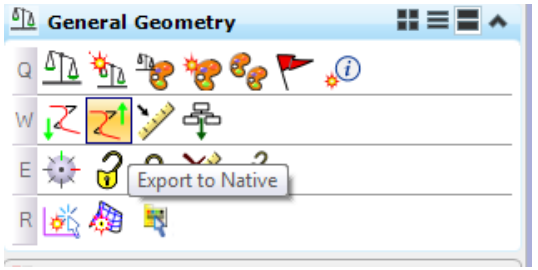
3. Right Click on the new Geometry Project and select Save As. If you completed Step 11 in the Step by Step start up you will see your project path on the top portion of the Save As dialog box. The Internal name you gave will be filled in the File name field. Select Save and Cancel.



3. Before exporting to the new ALG file make sure all Horizontal and Vertical Alignments have a feature name.
   A. Click on the horizontal alignment in check Element information locate the *Feature Name* field. If it is blank give it a name.
   B. Click on the vertical alignment in check Element information locate the *Feature Name* field. If it is blank give it a name.



4. Now you are ready to complete the export on the Task menu. Select *Civil tools > General Geometry > Export to Native.* Follow the prompts and select the Horizontal alignments you wish to export. It is not required to select the vertical alignment because they are children of the Horizontal and will automatically export with the Horizontal.
   - If you do try and select the verticals MicroStation will lock up and you will be kicked out of the application.
   - If you do not see a vertical appear in the alg it's because a Feature Name is missing (go back and do step 3)



Section 6.1 Plan Sheets

Section 6.2 Profile Sheets

Section 6.3 Cross Section